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MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C [illegible]NE Canada $3.75

Hand-Launched R/C Gliders!

Setting Incidence

Helicopter Engine Tips

Radio Control Fun!

Basics of Flight

Southwest Fan-Fly

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JUNE 1987 VOLUME 114, NUMBER 6

MODEL AIRPLANE NEWS

ON THE COVER AND ABOVE: The talented Budd Davisson once again uses photographic sleight of hand to capture the beauty of flight. A WACO UPF-7 is plucked from his hat this time, along with nature's own blues and greens.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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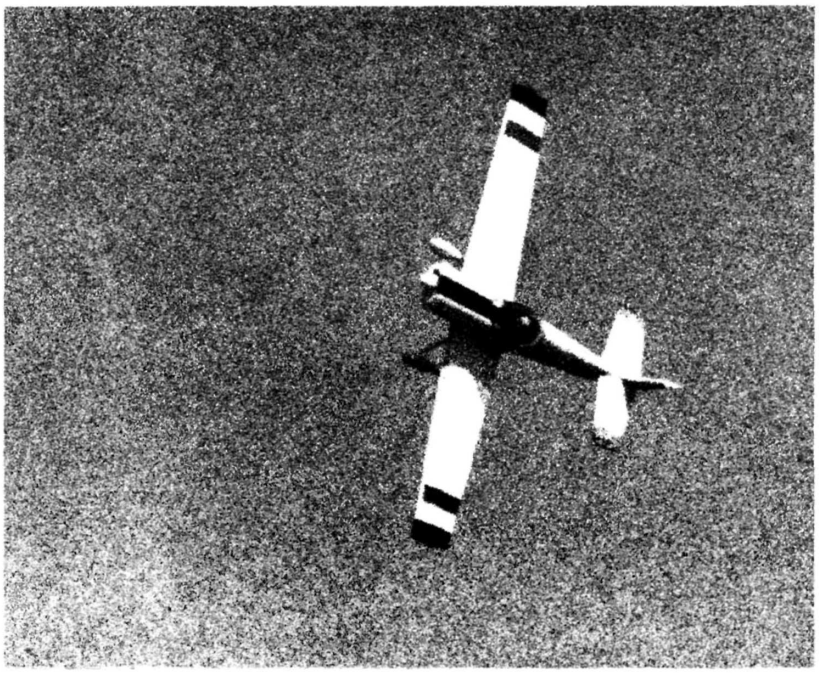
Editorial

by LOUIS V. DeFRANCESCO, JR.



HAND-LAUNCHED GLIDERS! Another R/C fad? Well maybe. But all indications tell us they're very popular and with the recent R/C car boom, they might be getting more popular since they are a simple way to get into R/C flying when just elevator and rudder are employed. For the advanced R/C enthusiast, all you need are a few more control surface functions like ailerons and airbrakes, and you have a hot-performing yet economical aerobatic soarer.

With this issue we offer you two hand-launched gliders: A neat kit from Top Flite called the Wristocrat and a scratch-built ship for you workshop artisans called the Zinger.

On another note, we're all well aware of just how popular scratch-building is, and though our series is postponed for this month, rest assured it will return very soon.

Down in Texas they do things big, and the Southwest Ducted-Fan Fly covered by our resident jet expert Rich Uravitch was no exception. There's a lot happening in ducted-fan technology and Rich was on the case to get you the latest scoop.

As with every issue of *Model Airplane News* we've packed a lot in for you, including some insight into basic aerodynamics, setting proper incidence, running those sometimes tricky helicopter engines, salvaging that damaged ARF, and much more. Plus we have some neat new products including the latest ARF manufactured in Italy by Aviomodelli. Leonardo da Vinci surely would have approved of this flight machine.

And speaking of flight machines, the venerable WACO UPF-7 is caught in animated suspension by the one and only camera of Budd Davisson. We feel that articles, like Budd's, on full-scale majestic aircraft are most inspiring to you, the R/C modeling enthusiast.

Enjoy! ■

Airwaves

Smiling Small-Stepper

As a regular reader of *Model Airplane News* since the late '50s, I wish to commend you on your return to the forgotten modeler in your column "Small Steps." Joe Wagner's writing is high quality, a rarity in hobby magazines. He obviously loves his subject, and packs a lot of clear, practical information into his articles. For a long time *Model Airplane News* seemed to be more of a rich man's magazine, a bit snobbish in fact toward those of us who can't afford, don't like, or don't have the space for the huge R/C models that seem to be in vogue these days. Many of us old timers are returning to model planes after many years and would like some attention paid to the planes we grew up with, ones in the .049 to .15 power range. They're a practical size for the sport flier and take up little space, and heaven knows that space is getting harder to come by. I believe that there is a resurgence of interest in all types of smaller models, rubber, CO_2, and tiny electric. I enjoy flying everything from ½A to HL gliders. Thanks again for "Small Steps," a step in the right direction. And thanks for writing that's directed to us guys who simply love the sport.

GARY BULLOCK
Pepperell, MA

It was certainly never our intention to snub anyone, but as you say, some things are in vogue. As a publication we must reflect the latest trends and interests. Believe me, Giant Scale is very popular as reflected by the attention it gets in all the magazines. Nevertheless, you're quite correct in pointing out the recent growing popularity of the smaller and quieter models. I guess now it's their turn. In light of this, we at Model Airplane News *are going to feature more ½A, electric, and other easy-tote craft. As you can see, we have a kit and construction article on one of the more recent trends, hand-launched gliders. I hope you see this as a positive beginning.* *CC*

Back to Basics

A couple of months ago I wrote to *Model Airplane News* about sticking to the basics. In my opinion your magazine has wandered off from its original format. I'd like to see a return to just model airplanes. The car people have their magazine, and so do the boat modelers. It just cranked me right up when I opened the February issue, and, lo and behold, right inside the front cover was an ugly car. Right away I got a bad taste in my mouth. I guess I just can't help it. I've been building airplanes since 1937, and I don't care to see this happening to a great magazine.

ROBERT N. DIXON JR.
Waverly, NJ

We only have control over the editorial content of Model Airplane News, *and have kept its contents separate in regards to cars, boats, and planes. Advertising is another story. Many of our advertisers carry cars and boats as well as planes. Since they are paying for their ad space, they have the right to choose which ad they are going to run, we can only advise them. But more importantly, you must accept the fact that the binding force is that they are all radio-controlled models. Naturally, there's bound to be a great deal of crossover. Personally, I partake in all three facets, although planes are my first love. I've had countless hours of fun with both cars and boats, and to me anything radio-controlled is beautiful. To say cars are ugly is subjective. Conversely, a sailboat is a thing of beauty, but that is also subjective. Nevertheless, we'll keep things, editorially speaking, clean and pure, now that there are the car and boat magazines.* *CC*

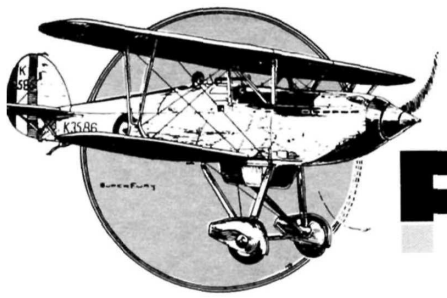
Perplexed

The purpose of this letter is really threefold. I have two questions to pose, and would like to tell you how much I enjoy your magazine. First, in the March '87 issue, Mr. Kalisher reviewed the Royal Chipmunk. I wish I'd read this prior to building my own Chipmunk. The tip on the elevator pushrods alone is worth the price of the subscription. I found that mine wouldn't even come close to balancing on the mark without extreme measures. I mounted a Super Tigre Bull Ring .46 and a four-channel Kraft fully forward in the fuselage with the battery under the tank. Even with this the aircraft balanced about ⅛ to 3/16 aft of the suggested point on the fuselage. This was without fuel. Do you have any ideas why it was so tail-heavy? How did Mr. Kalisher get his to balance with a .30? My second question deals with the "Four Cycle Forum." When can we expect to see an article on the new O.S. .48 Surpass? I'd really like to know how it compares to the Enya in thrust, power/weight and power/displacement. I sincerely appreciate any assistance you can provide. Lastly, let me say I really enjoy your magazine. I always read it from cover to cover, even the section on full-scale! Keep up the good work.

MIKE BRACKET
Hawthorne, CA

Quite frankly, I'm very perplexed as to why your model came out tail-heavy. The servo tray that's provided in the kit "clicks" into place, and that's where it is on Reed's plane. I've personally flown the model in very strong winds and it tracked well without any tail-heavy tendencies. Reed's plane has an Enya CX .40 ball bearing motor which is no heavier than your Bull Ring .46. Furthermore, Reed has informed me that he now has an Enya .25 ball bearing because the .40 power wasn't necessary. All I can guess is that you must've added weight someplace, i.e., too much epoxy or very heavy pushrods with your kit. I'm very familiar with this kit and would appreciate more information from you so that we can get to the bottom of this weighty conundrum. *CC*

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," Model Airplane News, 632 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.



Fifty Years Ago

by ART SCHROEDER

FIFTY YEARS AGO, America—indeed, the world—was still enthralled with Charles Lindberg and his spectacular flight from New York to Paris. Even though a decade of flight had passed, that flight was captivating. *Model Airplane News* responded to the continued interest in that historic event with its feature story, "The Plane That Flew to Paris."

In his feature article, Jesse Davidson gave insights into the flight, and the events that led up to Lindberg's success. In more modern times, events from Moon landings to Super Bowls fail to generate as much interest as that 1926 event. There was no TV, precious little radio, minimal videotaping—but incredible print coverage. It was a media event, one of the first.

To celebrate the tenth anniversary of Lindberg's flight, the June '37 *Model Airplane News* included a two-plate plan for constructing a solid model of Colonel Lindberg's Spirit of St. Louis, a Ryan aircraft. Solid models were the static "plastic" models of yesteryear that were carved from block and sheet balsa. Cabin areas were hollowed in some cases so interior details could be developed. Bamboo, paper, balsa, pine, pins and wire were the materials of record. Tools were simply a knife and some sandpaper. Glue was often old film dissolved in acetone or Casite, when water glue wasn't employed. It all sounds so primitive today, but the results were often spectacular. Just as often, though, they were awful; but we loved our efforts. The solids didn't fly, but we could make airplane noises as we moved them around with our hand.

Just for the record, that 1926 Lindberg flight was truly the "spark plug" for the incredible growth of model aviation in the thirties—a time when an engine's furious melody had all of us rushing outside to look. We don't do that today. But, then, airplanes weren't as commonplace; they were vibrant and conquering curiosities. Many of us became modelers as a result (we couldn't afford the full-size birds) and anything that flew, or even looked like it flew, was compelling. Fifty years ago was aviation's finest and most visible time for both full-scales and models.

Charles A. Lindbergh by Julius Pinsky.

There were names of fame in that June 1937 issue: H.A. Thomas, Thracy Petrides, Bill Brown, Melvin Yates, Elbert Weathers, Jesse Bieberman, Al Lewis, Reginald Denny, George Johnson (founder of *Model Airplane News*), Frank Zaic and many others. Yates apparently liked big models and I found the following of interest, keeping in mind that it is from a June '37 magazine: "Though many builders like to build smaller ships for convenience, it is without question true that more can be learned by building extremely large ships which approach the dimensions of full-size planes"! This was also an issue wherein *Model Airplane News* began publishing news of the National Aeronautic Association's early modeling efforts. For those who don't know, it was the beginning of AMA.

Another of many engines emerging in 1937 that never made a real impact.

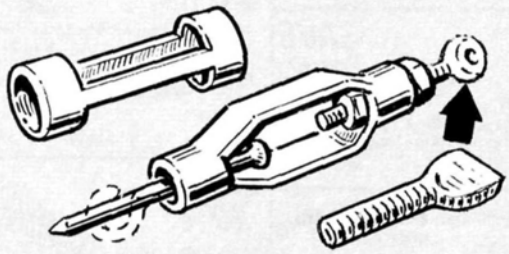
Scientific Model Airplane Co. of Newark, New Jersey, ran ads for the author's favorite airplanes of that time, the Red Zephyr and Miss America. Imagine, the six-foot Zephyr cost only $6.95. But that was as hard to come by then as $100 is today. Maxwell Bassett's Miss Philadelphia, the airplane that started the move toward gas engines, was also advertised by Scientific at an incredible $9.95. I didn't build that one—my Liberty magazine route wasn't big enough!

Anyway, aviation along with model aviation was growing rapidly fifty years ago and *Model Airplane News* was there with Charles Hampson Grant showing the way. ■

Hints & Kinks

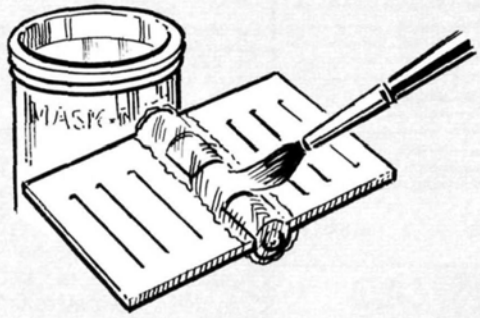
by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



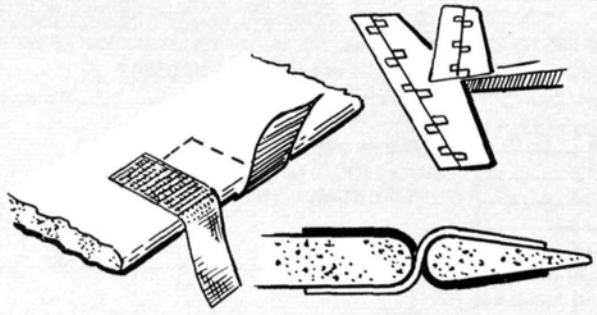
Needing sub-miniature turnbuckles, he made his own from brass tube, filed as shown, a pin or small brad for the swivel end and a flattened 0-80 screw with the end drilled. Note the two nuts for adjusting and locking.

F.A. Botari, Welland, Ontario, Canada



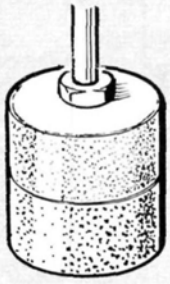
One of the hardest jobs is preventing hinges from being "frozen" by glue getting into the knuckle. One answer is to paint the hinge knuckle with Mask-N-Peel, a rubbery coating available from your craft store. You can also try Liquid Frisket used by airbrush artists and available from your local graphic arts supply store. After gluing the hinge in place, the rubber coating easily peels away.

John Ribble, San Jose, California



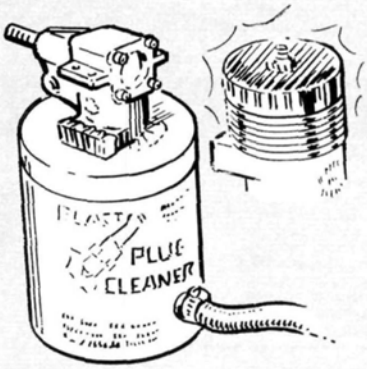
An old idea from U-control days but not known to newcomers are these very simple, free-operating hinges made by gluing or doping nylon tape above and below the surface, to cross as shown. They work like the old sewn hinges, but are neater, being easily hidden by the covering—ideal for very small models with thin surfaces.

Gordon Rae, Gt. Malvern, Worcestershire, England



Instead of constantly swapping sanding drums or bands when a different grit is required, why not adopt this technique? Cut two different grit bands to half their width and mount one of each on the same drum. Now you will have coarse and fine sandpaper on one sanding drum.

Ian Emory, Marysville, Washington



If you have a small sandblaster used for spark plugs, it can be used for removing baked-on varnish from the head and fins by inverting the top of the engine in the modified lid. Be sure to thoroughly seal carburetor and exhaust with tape and wash exterior of engine thoroughly before removing tape.

Jose Vargas, La Paz, Bolivia

When masking off parts of models for spray painting, our contributor wraps components in cooking foil because it molds easily to shape and stays put. Ideal for smaller parts, such as landing gear wires, etc. He credits his wife with the idea.

Thomas Ault, Claremont, California

Zinger

A hand-launched high-performance glider with three-axis control.

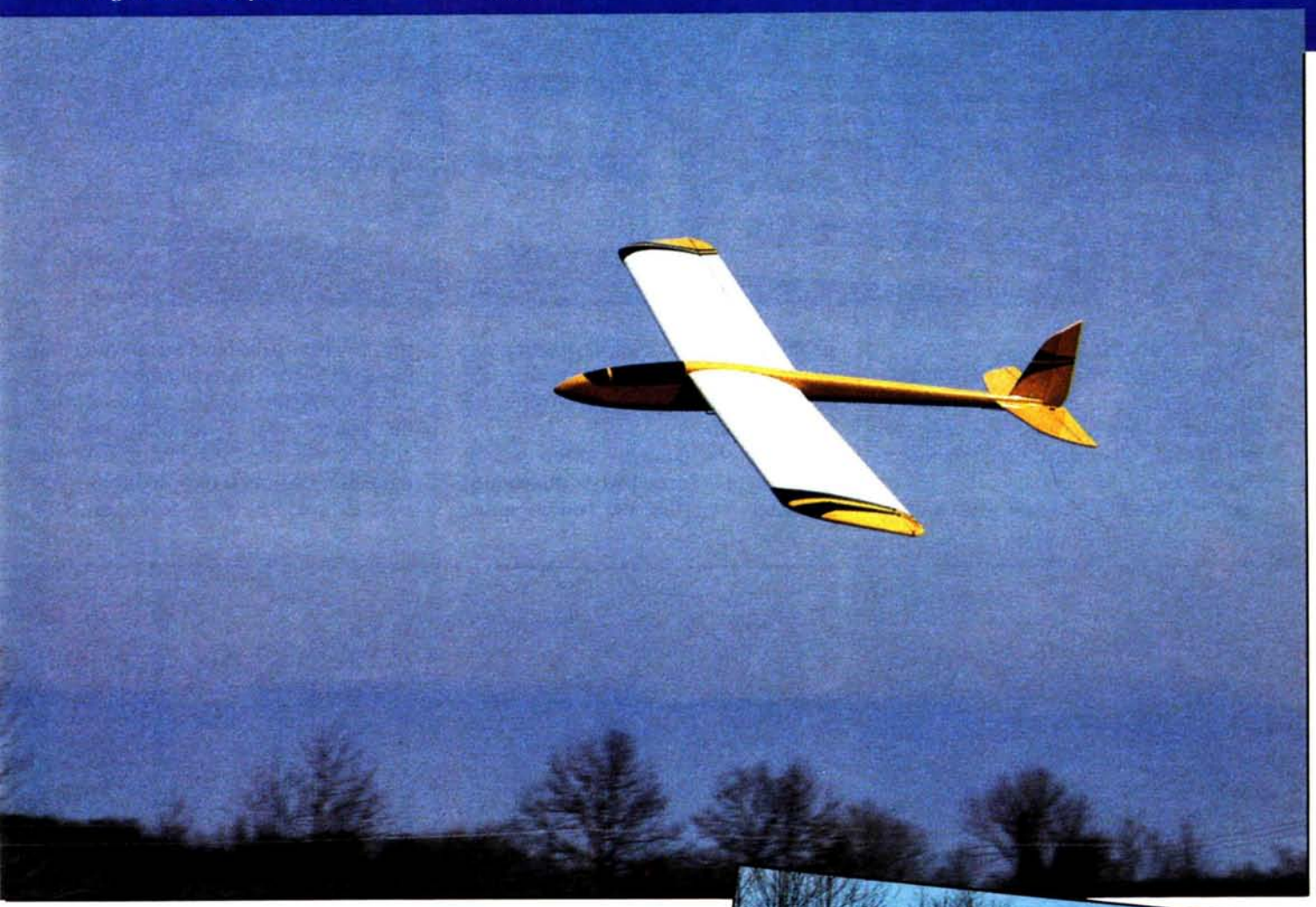
by BOB COOK

THERE has been a recent surge of interest in hand-launched gliders which has come about for many obvious reasons. These small gliders are low in cost, fast building, easy to transport, and can be flown almost anywhere. I could go on and on with the virtues of these planes, but the bottom line is that they offer the most fun for the least effort in the sport of R/C flying today!

With this in mind, I set out to create a design that would provide the ultimate in hand-launched performance! There are several other hand-launched gliders now available, but all of these are quite similar and very simple in design and construction. I have retained many of the proven features of these tried-and-true designs, then took it to the limit utilizing many features not seen in planes of this type until now. Every effort has been made to keep the design as aerodynamically clean and efficient as possible.

One obvious departure is the use of a "flat" wing with aileron control. I feel that the efficiency of this wing far outstrips the polyhedral-type wings. I think penetration is better and the glide angle is extremely flat. Turning is very smooth and precise. I have found it is best to couple the rudder to the ailerons for sport flying. The undercambered airfoil offers a wide speed range and yields tremendous height in launching, yet floats nicely in those light thermals. The constant chord planform of the wing not only makes building easy, but it packs the

Type: *Hand-launched glider*
Wingspan: *60 inches*
Wing Area: *400 square inches*
Wing Loading: *5.5 ounces per square foot*
Radio: *Two- or three-channel with three micro servos*



maximum wing area into the 60-inch span, keeping the wing loading very light. Although competition rules vary from place to place, the 60-inch span seems to be the accepted limit for hand-launched gliders. If your club or area has special regulations, you may simply add or remove rib bays during the construction of the wing to end up with the required span.

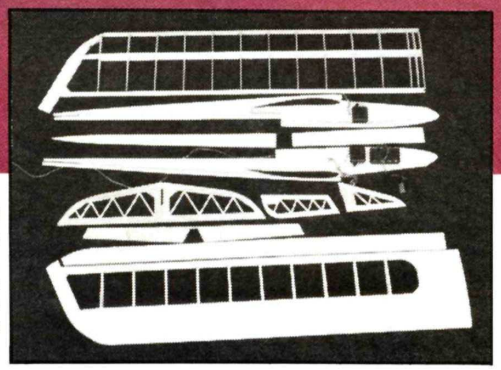
The Zinger features a unique step in the fuselage profile, taking the place of the customary finger hole found in most hand-launched gliders. I've found that a lot of you guys have fingers that can't fit into the slim fuselages of these gliders, and the step-type finger rest eliminates the problem. The glider has a fully rounded and streamlined fuselage contour to keep drag to a minimum.

If you're ready for a glider with state-of-the-art design and outrageous performance, build the Zinger!

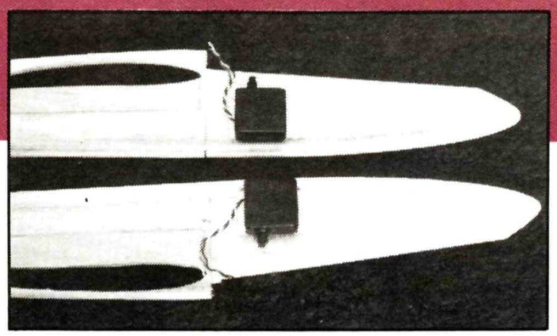
CONSTRUCTION. Although the Zinger is a bit more complex in structure than typical hand-launched gliders, anyone with some building experience with performance-type gliders should have no trouble with the construction. You should note that the plans and instructions are intended for someone who is familiar with building R/C airplanes. They do not always go into the level of detail that might be required by the beginner.

Working directly over the plan, pin down and glue the fin and rudder outline parts in place. Now add all of the gussets. Add the fin base parts, followed by the cross bracing. Remove the fin and rudder from the building board and shape to the contour shown. Cut a small notch in the rudder to clear the elevator dowel. Note that the base of the fin forms a tab which will index into a slot in the stabilizer. The leading edge of the rudder should be beveled to a sharp edge while the other edges of the fin and rudder should be rounded.

The stabilizer is framed-up in a similar manner to the fin and rudder. Begin with the outline pieces, then the cross bracing. Be sure to leave a ⅛-inch wide slot in the



All completed parts for the Zinger structure. A bit more complex, anyone should be able to build the glider.



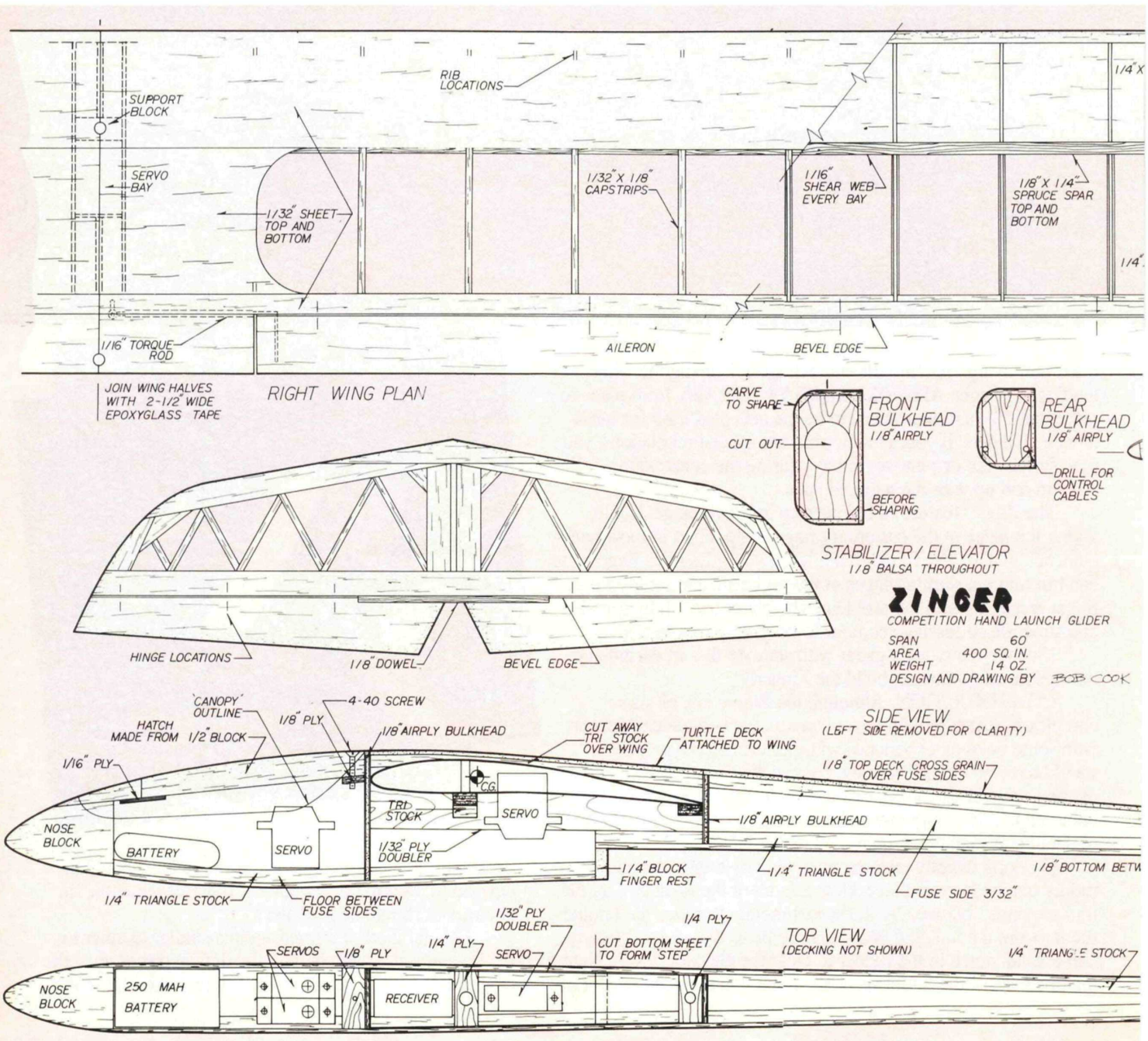
Basic fuselage sides with doublers and triangle stock located. At this point radio gear location must be planned.

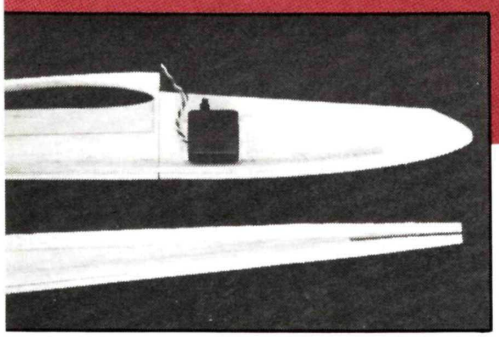
middle of the stab.

The elevator halves should be notched-out and joined with the connector dowel. Bevel the leading edge of the elevator and round off the other edges of the stabilizer and elevator.

Insert the fin into the slot in the stabilizer and bond in place, making sure that the parts are 90° to each other. The rudder and elevator will be covered and installed later.

Due to the complex airfoil section, special care is needed when building-up the wing. Note that the bottom spruce spar will have to be blocked up with scrap pieces of ⅛-inch balsa in order to raise it up off the building board. Make sure that the bottom spar is set fully into the notches in the ribs for a flush fit. The tails of each rib will also have to be elevated with scrap pieces of ⅛-inch balsa. This





Triangle stock must be tapered at the rear of the fuselage to allow bringing the sides together. Note relief notches.

will allow for the trailing edge to be sanded to the proper undercamber of the airfoil section.

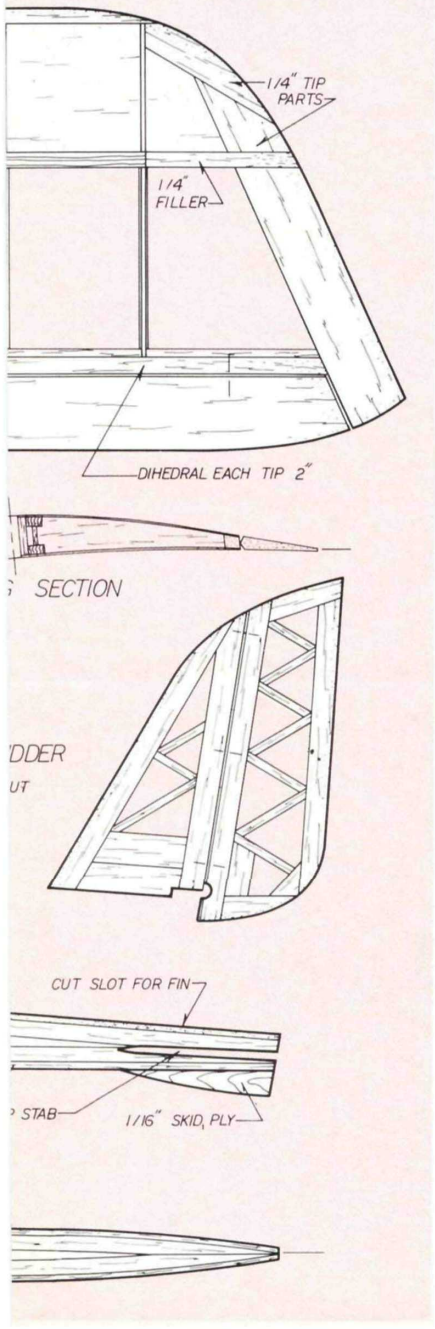
Start by building the right wing panel first and then repeat the procedure for the left panel. Pin the bottom spar over the plan with ⅛-inch scrap balsa underneath. Don't pin through the spar, but rather pin on either side.

Bond all ribs, except the centermost one, in place on the bottom spar with shims of ⅛-inch scrap balsa under the tails of each. Now glue on the leading edge and the trailing edge. Note the location of the shear webbing shown on the wing section drawing. Cut and fit shear webs for every rib bay. The webs should sit on the top of the bottom spar and be just high enough to touch the bottom of the top spar when it is installed. The webs should also butt against the ribs on both sides. Now install the top spar. Form the wing tip parts and bond in place. The tip filler piece is now glued in place, butted up against the side of the last rib and over the top of the wing tip piece. The filler should be shaped to make a smooth transition from the spar to the wing tip.

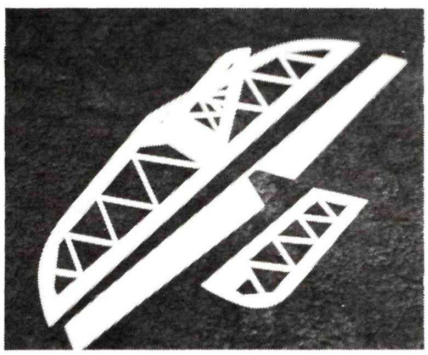
Next, carefully sand the leading and trailing edges to the airfoil contour shown in the wing section drawing. Insure that the undercamber is maintained when shaping the trailing edge. The wing tips should be sanded to accept the wing sheeting. Now frame up the other wing panel up to the same point.

(Continued on page 95)

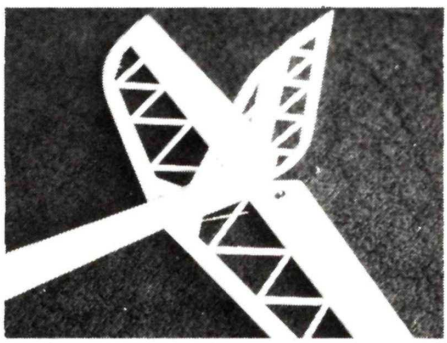
Cook is a prolific designer. Aircraft lineup (l to r) Zinger, Thunderbolt, and Wizard. Lady lineup: left, Denise Ganley and, right, Lucy Scaturro.



FOR ORDERING INFORMATION, SEE PAGES 124, 125



Tailfeathers are simple, shaped, flat items, easy to build and very strong.



Attachment of tail surfaces is through slotted openings in the basic fuselage structure.

Basics of Flight

Understanding the physical laws of flight is the secret to being a natural.

by the Model Airplane News Staff

THE PURPOSE of this article is two-fold: to introduce the reader to the names of various aircraft parts and to look at some basic principles which govern stable flight. Even if you do not thoroughly digest everything we have to say, and even though we shall not deal with detailed trimming adjustments, you will be forewarned on one or two points. It is certainly better that you know some of this before you try to fly that first model.

In Figures 1 and 1A are the names of the main parts of an airplane. The use of two terms for any one part stems from differences in British and American usage. In our hobby there is also considerable freedom in the use of alternative names for certain parts. A side strut between two longerons, for example, may be called a vertical spacer, an upright, or a side member, or variations and combinations of these terms. Longerons, however, which are main longitudinal members, should not be confused with stringers whose main purpose is to support outer covering and preserve external form.

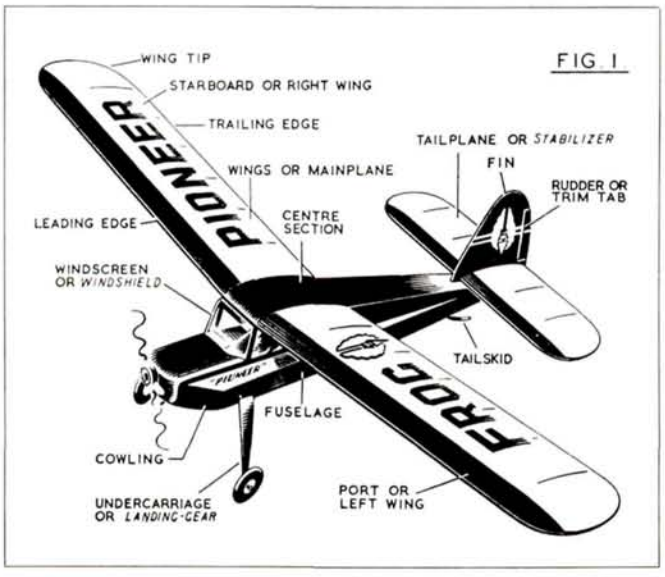
The Four Forces

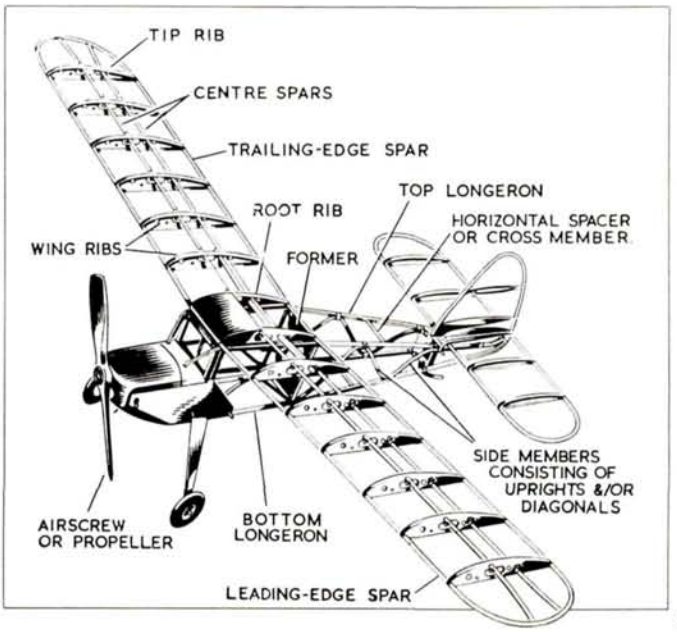
Here, we only want to explain, as simply as possible, the basic principles of airplane flight.

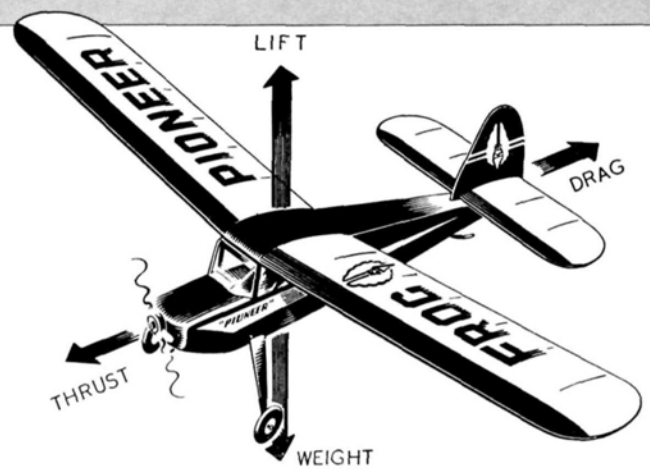
Figure 2 shows the four main forces acting on an aircraft in flight. First, there is thrust produced by a propeller or jet motor which moves the airplane through the air. In opposition to this force is drag, which is resistance to forward motion produced by moving through air. Thirdly, we have lift, an upward force generated by the wings due to their movement through air which is opposed by weight or the force of gravity acting downward.

In steady, level flight, the forces of thrust and drag are equal while lifting force equals weight. *Read the previous sentence again.* Some people find it difficult to understand that this is so and assume that thrust must be more than drag, and lift more than weight. Let us explain in more detail.

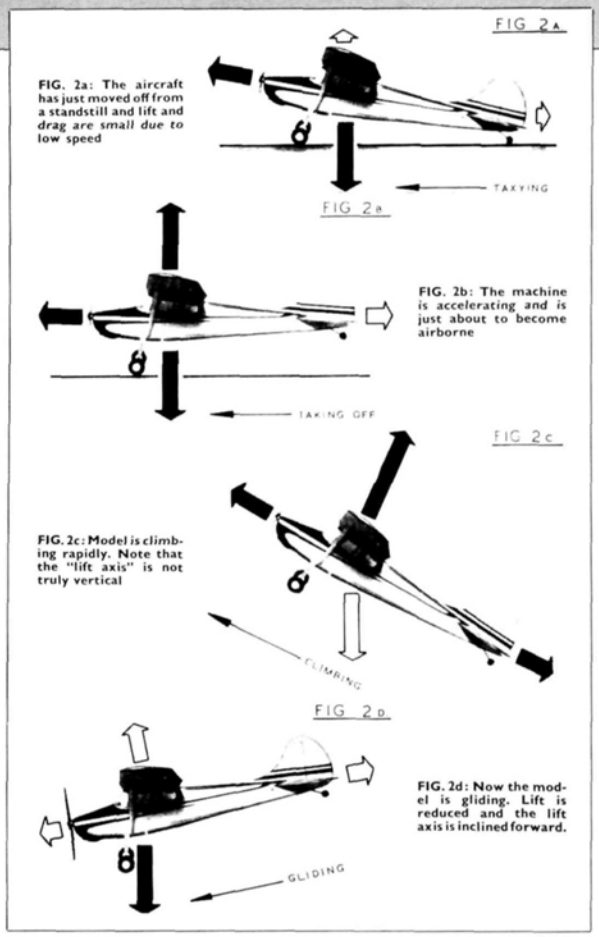
When an airplane begins to taxi, the thrust is many times greater than drag and weight many times lift (Figure 2A). As the aircraft moves faster, however, the differences are reduced. When a certain speed is reached, lift equals weight (Figure 2B) and then exceeds it. When this happens, the aircraft leaves the ground in a climb. With ground resistance removed, the aircraft continues to accelerate until drag equals thrust. The







Above: This illustrates the four forces—lift, weight, thrust, and drag—involved in aircraft flight. In steady flight, lift equals weight and thrust equals drag.



speed will now remain constant, as will climb rate. Therefore, we now have thrust and drag equal, but lift force is greater than weight (Figure 2C).

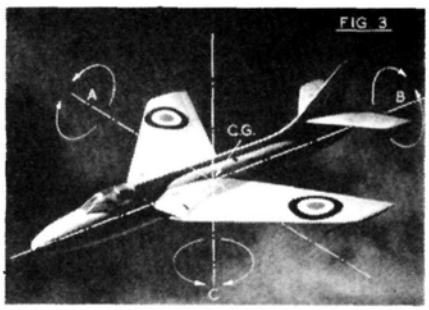
In free flight this condition would continue until the engine stops. But we fly R/C, so we can follow full-size practice by reducing engine speed until lift equals weight and the aircraft flies at a constant speed and altitude. At any point we can use engine speed to increase our climb rate or reduce that rate. It is all part of the fact that engine speed is our true altitude control—high speed gives climb, idle gives a sink angle.

Suppose now that the engine of our model stops. Thrust is lost and drag will slow the aircraft. As a result, lift will be reduced. Weight (or gravity, if you prefer) will now cause the airplane to descend. Will it plummet to earth? No, because drag will limit its speed and the wings will still generate enough lift to cause a gradual descent, i.e., a glide. Some aircraft glide better than others (or have better sink rates); but, so long as those wings are moving in air, they will generate lift. One also must hope that an aircraft without power doesn't become unstable (Figure 2D).

How is this stability ensured? For this we have to look at the three axes.

The Three Axes

Like every solid object, an airplane has a center of gravity (Figure 3) and whenever it points upward, downward, or sideways, or rolls to the left or right, it does so with the center of gravity (CG) as a pivot point. So, for the purpose of studying stability, we declare the airplane to have three axes, marked A, B, and C in Figure 3.

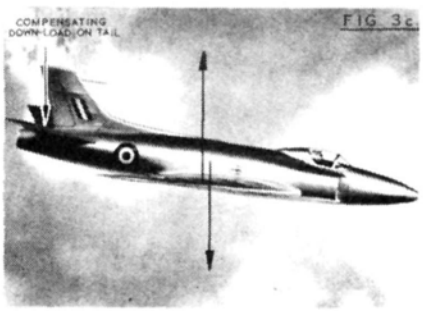


The three axes about which longitudinal, lateral, and directional stability are attained.

Axis A is known as the lateral axis. The nose-up and nose-down movements the aircraft makes on this line are called pitching. Axis B is the longitudinal axis and when the airplane banks left or right, this is called rolling. Axis C is called the vertical axis and directional movements left or right are called yawing. Pitch, roll, and yaw—all terms of nautical origin.

Longitudinal Stability

Our first requirement is longitudinal stability, which concerns pitch. A little confusing, perhaps, but we must remember that this takes place about the lateral axis—not the longitudinal axis.



Nose deflected downward, center of lift moves back. Downward stab force restores balance.

We've seen that a wing produces lift when moved through air. The amount of lift it produces depends primarily on the speed at which it travels, and its angle to the airstream is called the angle of attack.

There is a point relative to the chord of the wing through which the lifting force is concentrated. This is called the center of pressure. The position of the center of pressure (CP) is not constant. At a zero

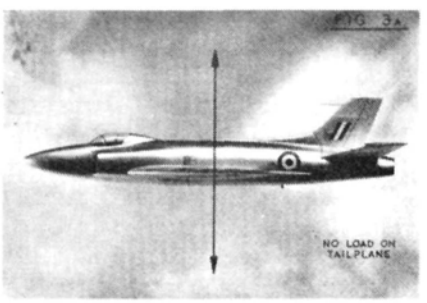
angle or very low angle of attack, the CP is near the mid-chord point. At high angles of attack it is nearer the leading edge. At negative angles the CP moves toward the wing's trailing edge. This presents something of a problem.

Let's suppose that we have balanced the airplane so that the CG is just below the CP at the required angle of attack. The two opposing forces are now in equilibrium with lift directly opposing weight.

However, if anything occurs to alter the angle of attack, i.e., if the airplane pitches, stability will be lost. If the nose rises, the CP will move forward in front of the CG and thus tend to lift the nose still more, in turn causing the CP to move yet farther forward, so that the wing will tend to rotate completely and turn the airplane over on its back.

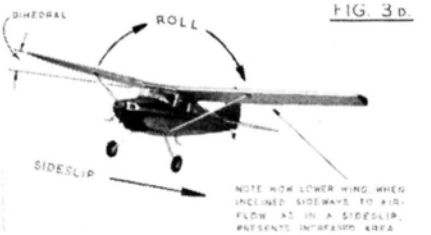
This is where the stabilizer comes to the rescue. The stabilizer is merely another, much smaller wing attached to the rear end of the fuselage, and it stabilizes the main wing.

In constructing our airplane we can now mount the wing on the fuselage at a suitable angle of incidence so that in normal flight it is inclined at such an angle of attack as to produce the required amount of lift. We can then arrange the CG to approximately coincide with the CP at this angle of attack and we mount the tailplane at zero degrees so that it merely "floats" in the airstream (Figure 3A).



Here we see steady flight with center of lift immediately above CG.

If flight conditions are disturbed in such a way that the nose is raised, the CP moves ahead of the CG and tries to make matters worse. But now our stabilizer is also inclined at a positive angle and begins to generate lift. Since it's at the fuselage rear it exerts great leverage and restores the aircraft to level flight (Figure 3C).



Dihedral angle of the wing maintains lateral stability. Lower wing presents increased area.

Lateral Stability

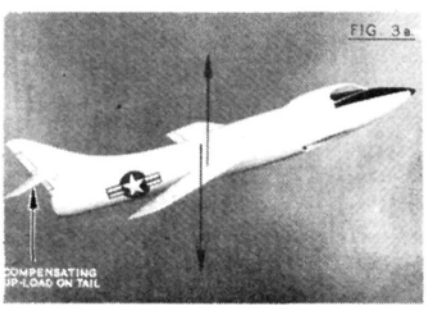
Lateral stability is achieved in quite a simple manner. If you look at an airplane head on, you'll see that the wings are usually inclined upward to form a dihedral angle (Figure 3D).

The more we incline the wings upward, the less will be the lift in a vertical direction. However, a roll to right or left also causes a sideslip in the direction of the roll. This is due to a small sideways force introduced by the entire lift being inclined sideways instead of acting in direct opposition to gravity.

Dihedral now acts as the correcting force. In moving sideways as well as forward, the lower surface of the wing presents considerable resistance to the inclined airstream and thus tends to roll the aircraft back to an even keel.

Directional Stability

The basic method of ensuring directional stability is to place more side area behind the vertical axis than in front of it. This is the reason for fitting a vertical tail, the principle can be likened to that of a weather vane.



Upward deflection, center of lift being moved forward. Upward stab force restores balance.

When an aircraft is thrown off course and yaws to one side, it continues momentarily in the same line of flight, crabbing slightly. Thus, the airstream is striking one side of the airplane and, in striking the considerable fin area, the aircraft is turned back to proper flight direction.

CG and How To Find It

Every solid object has a CG and, so far as aircraft are concerned, we need to know where it lies. It is the first thing we need to determine, for example, before we attempt to fly a new model. If necessary, we ballast the model in order to relocate the CG to design requirements.

When talking of models, one frequently refers to the position of the CG, relative to the wing chord, as 30%. This means the CG is vertically in line with a point 3/10 the distance back from the leading edge. The simplest way of finding out whether a model is longitudinally balanced is to lift it with your fingertips placed in appropriate positions under the wing. However, this establishes the balance in one dimension only, and though we may assume that the aircraft is properly balanced about its longitudinal axis, we still do not know the vertical CG position. It is sometimes desirable to know this precisely, especially, for example, when determining the towhook position on a glider.

First, hang up the model slightly in front of the estimated balance point. The airplane will hang at an angle, tail downward. From the point of suspension, draw a vertical pencil line down the fuselage side with a plumb bob (it would be wise to place a strip of masking tape on the approximate line before it is drawn to avoid finish damage).

Now suspend the aircraft from a point rearward of the estimated balance point. The model will now hang at an angle, nose downward. From the point of suspension, draw another vertical pencil line, using the plumb bob, down the side of the fuselage.

Where these two lines intersect establishes the CG. ■

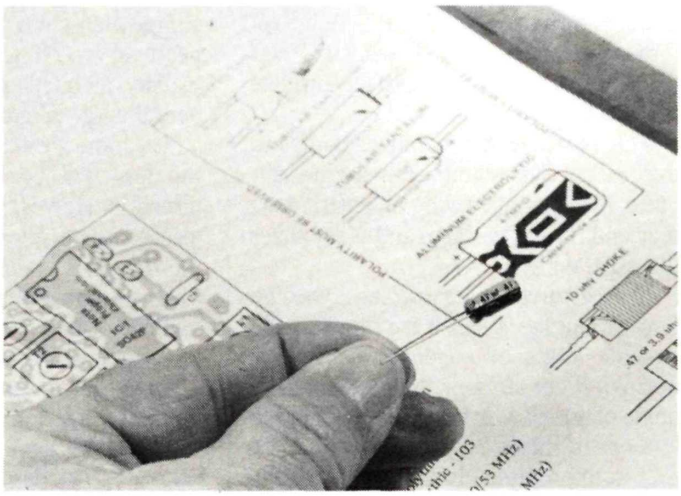
Why not build

Basics of Radio Control

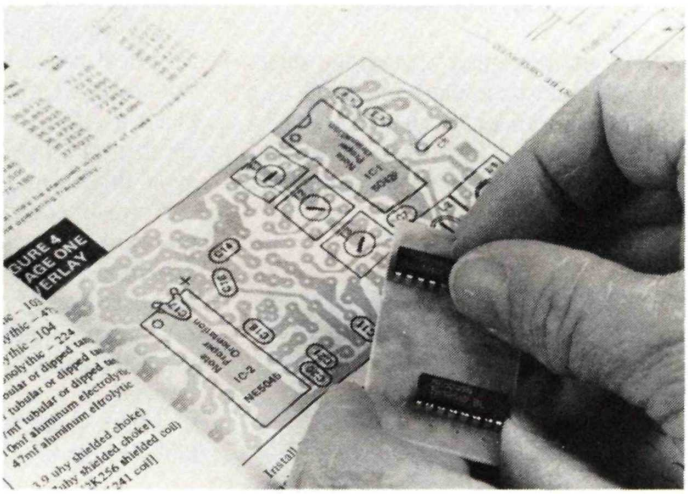
by RANDY RANDOLPH

RECEIVER operation has been discussed at some length in these pages. Now it's time to look at the nuts and bolts of these magic boxes. Actually nuts and bolts are not the proper terms: "coils," "condensers," "resistors," "diodes," "RF chokes," "transistors," and "integrated circuits" being more to the point. An integrated circuit is simply more condensers and resistors, along with some diodes and transistors, that are reduced in size and poked into a small package.

By far the best way to lose any fear of something is to take it apart and see what makes it tick. Fortunately, the Ace R/C* people have already taken a very good receiver apart just for us to put back together! When it is put back together, it not only becomes a very good receiver, but an inexpensive one as well! In this case education *saves* money.



Part identification is a first step for any kit. This is an aluminum electrolytic condenser. Parts are identified against a diagram sheet.



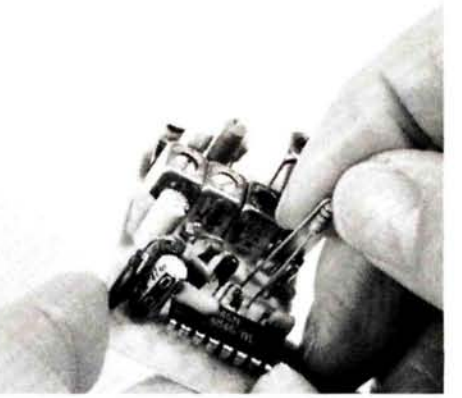
Parts are placed on the top side of the circuit board preparatory to soldering. Follow circuit overlay very carefully during this operation.

There is little difference between the way receivers are assembled by manufacturers and the way you and I assemble one on the kitchen table. If someone can assemble one in just a few minutes at the Futaba factory, what could be so difficult? The trick is to know where each part goes. In the kit, the assembly manual is the textbook and the diagram of the printed-circuit board is the plan.

As with any kit the first thing to do is become familiar with the parts. The manual pictures all of them and describes the way each is labeled for identification. The parts in our radios are no different than those used in any radio, TV, or

a receiver kit?

The parts are then soldered to the bottom side foil. A small-tip soldering iron is necessary.



Resistors are typically installed upright to reduce space requirements.

Long leads are cut even with the bottom of the circuit board **after** *they are soldered to the foil.*

computer, so once they become familiar it's easy to spot them in other appliances.

The circuit board is drilled to fit the proper part in the proper place. Once the parts are identified, they are stuck through the holes in the top side of the circuit board, as shown in the layout, and soldered to the foil on the bottom side. It's easier to install a few parts at a time and solder them, then add a few more, etc. They should be soldered to the foil before the extra leads are removed.

Once all the parts are on the board, the receiver must be aligned. The term "alignment" means that the receiver must be tuned to your transmitter just as a radio or TV is tuned to a station. In each of the shielded coils is a threaded slug which can be adjusted to bring the coil into tune. It's not a difficult procedure, but you must have a tuning wand, which is a little plastic screwdriver, and a good voltmeter or oscilloscope. Or you can take the receiver, manual and your transmitter to your local repairman and get the job done in short order. Don't forget to take a battery pack as well!

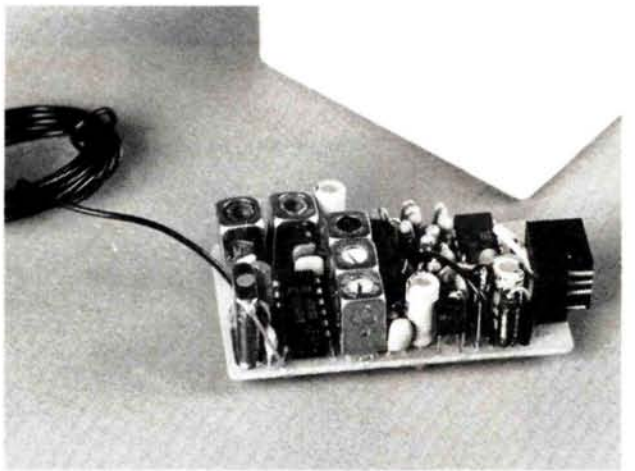
The receiver shown in the photographs was modified to be used with Kraft servos by installing a Kraft terminal block on the board. This one came from Scott Kalmus of Kraft Greater Southwest. Terminal blocks, or connectors, to fit most other servos can be ordered from Ace R/C along with the receiver kit.

For a small investment in time and money it is possible to discover a great deal about radios and get a state-of-the-art receiver in the bargain. So, why not!

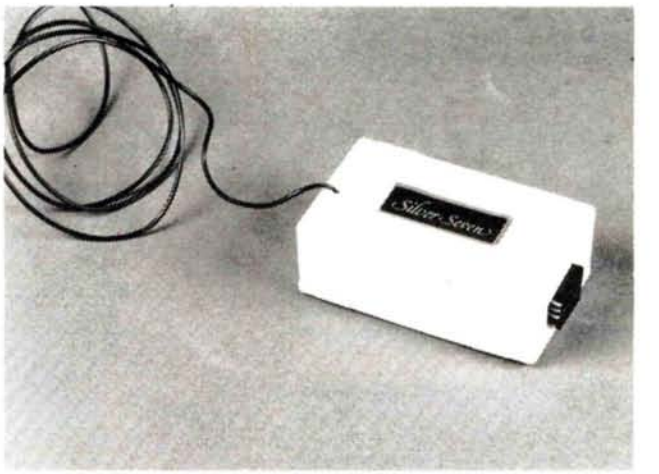
Randy Randolph, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Ace R/C, Inc., Box 511C, Higginsville, MO 64037. ■



The completed receiver with a Kraft terminal block installed. The shiny cubes are coils with a tuning slot on top.



This is your bonus for the work done. One of the best state-of-the-art receivers, plus an education.

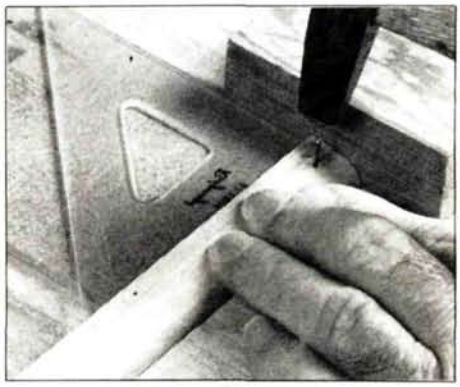
How To:

by RANDY RANDOLPH

MAKE A SANDING JIG

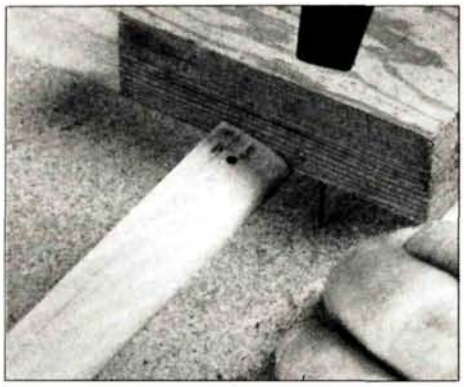
The increased use of cyanoacrylate glues has made it necessary to obtain good, tight-fitting joints throughout construction. A simple jig to square the ends of strips or sheet balsa is a very useful tool. The photos show the way.

1.



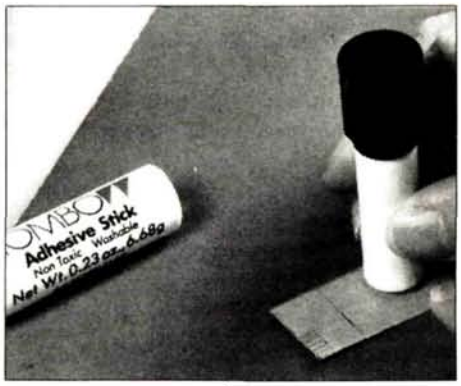
2.

1. The materials necessary are a 12-inch square of ½-inch plywood, a 6x8-inch piece of ⅛-inch hardboard, a strip of hardwood at least ½-inch square and 6 inches long, a 4- to 6-inch length of 1x2-inch hardwood and some sandpaper.



3.

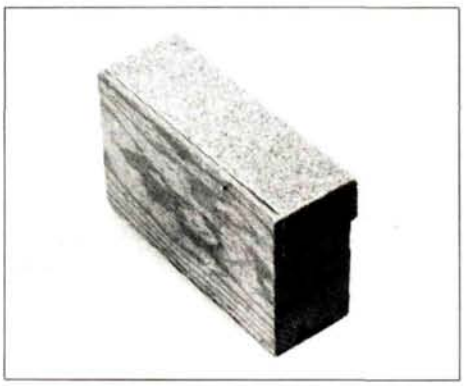
2. Cut a 2-inch-wide strip from the bottom of the hardboard, making sure it is at right angles to the sides. Tack and glue the remaining 6-inch-square piece to the center of the plywood, then tack and glue the hardwood strip as shown. The end of the hardwood strip and the side of the hardboard must be flush with each other.



4.

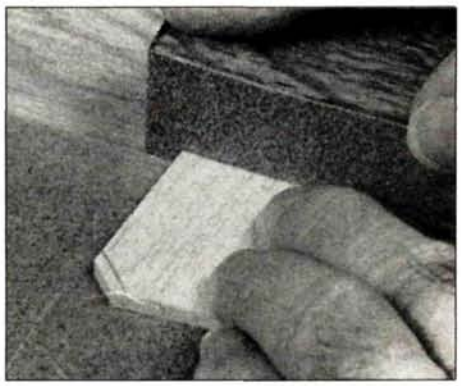
3. Tack and glue the 2-inch strip of hardboard below the hardwood strip. Again, the edge must be flush with the others. Use a right triangle to be sure the edges of the hardboard are square with the hardwood strip.

4. Cut a ¾-inch strip of 100-grit sandpaper. Rub adhesive from a glue stick on the back of the sandpaper. Aluminum oxide paper works the best and lasts longest in this application.



5.

5. Glue the sandpaper strip to the long side of the 1x2-inch block. Leave a 3/32-inch-wide space between the bottom of the block and the bottom edge of the sandpaper as shown.



6.

6. To use the sanding jig, hold the piece to be squared against the hardwood strip and against the sanding block. Slide the sanding block up and down against the hardwood guide while keeping it flat against the plywood base.

WHEN WE THINK of WW II trainer biplanes, most of us are hard-pressed to think of anything but the trusty old PT-17 Stearman. Sure, maybe a few will come up with the Navy Airplane Factory N3N, but few if any remember the WACO UPF-7 as being one of the schoolmarms of early WW II.

In point of fact, only a very few WACO UPFs became YPT-14s, the military's designation for it as

WACO UPF-7

article and photos by BUDD DAVISSON

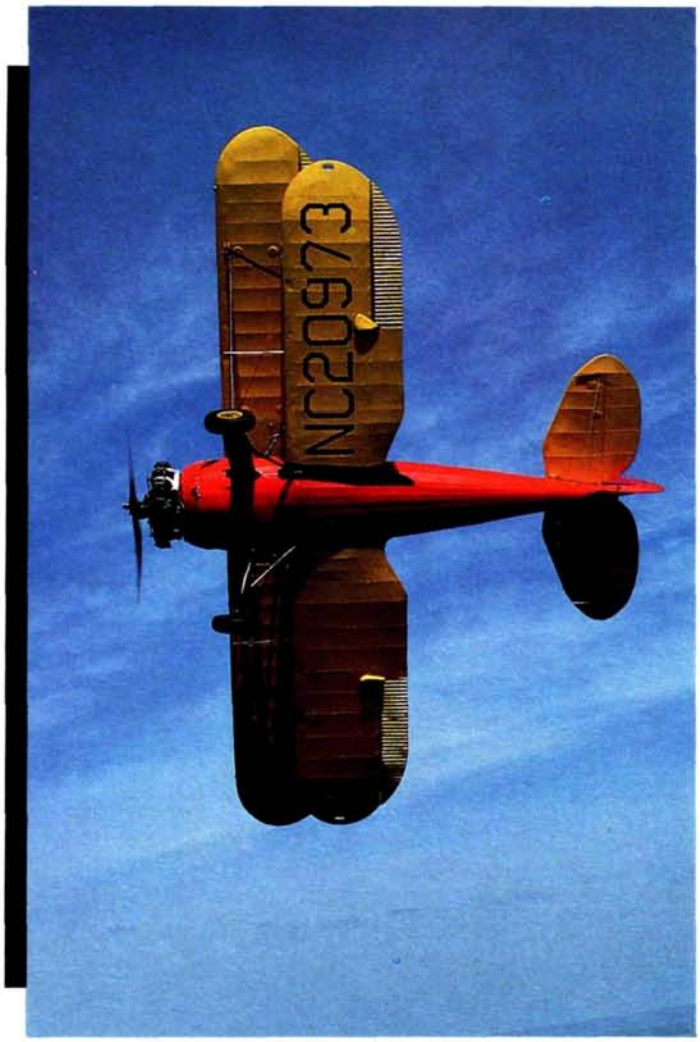
a trainer. However, large numbers of them did serve in the civilian pilot training program (CPT) and in so doing paved the way for pilots heading into military basic training.

As an open-cockpit biplane, the UPF-7 is unique. In the first place, it was an anachronism from the day it was born. By 1937, WACO was producing almost entirely cabin biplanes and no one seriously considered wind-in-the-face aviating as any way to go across country. Still, the UPF was a three-place—one in back, two in front—cross-country runner. Early specification sheets showed that she was supposed to be capable of nearly 130 mph on her 220 Continental. The fact that very few of them can top 110 today may be due to old age adding wrinkles here and there, or over-enthusiastic copywriters in the old days. But, fast or not,


WACO
NC
20973

she was still one of the only WACOs designed from the beginning with training, as well as point A to B utility, in mind.

From an appearance standpoint, the UPF had none



of the characteristics one normally associates with WACOs. The PF airframes were distinguished by the large swooping dorsal fin and wide stance landing gear that are only vaguely similar to some of the earlier machines. These lines make the UPF stand apart from its brethren and make them easy for a WACO enthusiast to recognize.

When you climb into a UPF, two things are going to immediately impress you. One is the relatively large size but "just right" feel of the cockpit. The second is the immense size of the tubular structure surrounding you. It's often been said that UPF stands for Union Pacific Freight because it's such a hefty monster. As you gaze around the cockpit, you'll find nothing unrecognizable to any biplane pilot of the 1920s or '30s. She's a basic, bare-bones biplane meant to get you up and down in the safest and most expedient way possible.

Sitting in her, even though her size is formidable compared to a Stearman or the earlier WACOs, she's practically miniscule. Still, to any '80s generation sport pilot, she's big, really big! And the fact that she tips the scales at 1,870 pounds empty tells you this is no tinkertoy home-built. Her W-670 220-horse Continental engine alone weighs as much as a complete Pitts Special.

When you reach up and tweak the starting switch, you're rewarded with this whining, rotating gear sound that's unique to small displacement radial engines turning over. The smart money counts at least three or four blades before switching on the mags, to be certain the bottom cylinders are truly cleared of oil, and you aren't risking a hydraulic lock and the resulting bent connecting rod.

Switches on, and the whine is replaced by an empty sounding cough, as one cylinder and then another finds the proper fuel/air mixture. The first explosions vaporize remaining residual oil and cough it out through the exhaust stack. In the first few seconds, the blue oil smoke is whipped around by the slipstream. But it immediately disappears as the engine settles down into a round engine song that you soon grow to love.

The UPF WACO isn't known for being a real bear on the runway. And it's also not known for having pussycat ground handling. As a pilot moves out toward the runway he'll notice how little actual visibility he has; an S-turn becomes an intinctive maneuver for survival. During the S-turns down the taxiway, the first hint of potential problems surfaces. If the S's get too deep, a little brake is needed to stop it from swinging the tail around at the apex of the turn. Mark this down in a mental notebook, because that's its way of telling the pilot that if it gets ahead of him on landing or takeoff, especially on pavement, it's going to go darting off into the bushes.

Lined up on the centerline, which you only can guess at since you can't see it, the power is brought gently forward, and those 50-year-old ponies in the nose do their best to drag the mass of tubing and fabric behind them ahead at a respectable rate. In the early part of the takeoff role it's not unusual to find a tiny bit of brake being used one direction or the other until the tail is hoisted up into favorable air, and the airplane is running on its mains. Once up on its mains, visibility increases to the point where the pilot can almost see what he's doing, but he'll notice the gear is a little soft and has a very slight side-to-side waddle. He may not even notice the waddling until he tries to fight a hard crosswind on takeoff. The fortunate part of all this is that it's happening around 50 mph, so there's no giant panic straining the brain to keep up with the airplane.

Given a little wind on the nose, the airplane is likely to grind its way off in a near-level attitude with no help from the pilot. But, as eager as it is to leave the runway, it's in no real hurry to gain altitude. This is no flyweight, remember!

The airplane continually reminds the pilot he's

working with a big one. The stick is quite above the knees, and some pilots have been known to fit the stick with an even longer extension to increase mechanical advantage, cutting down on the control forces. "Dainty" is not a good word to describe its control feel. It makes the pilot work for what he gets.

In normal flight, the control forces aren't likely to be noticed. But put the nose down for some extra speed and then pull it up. Twist the ailerons into a roll, and the forces will let you know they are there. No muscles are going to be ripped, but most pilots will find it hard to roll to the right with only one hand on the stick.

In reality, the airplane requires only slightly more muscle than a Stearman.

To any '80s generation pilot, she's big, really big!

Unfortunately, when you see Jimmy Franklin twisting the tail of his big-engine UPF at an airshow, you think the airplane's helping out more than it really is. When Franklin flies, what the crowd actually sees is a man with tremendous arm muscles and fantastic skills. The airplane isn't helping him out one bit. Nada. None.

Turning final in the airplane, the pilot only has to pull the power full-off to remind himself he's in a high-drag, wind-in-the-wires flying machine. Gliding is not the strong suite of any biplane of the era. Unless you define gliding as falling out of the sky like a clod of dirt. But just the tiniest bit of power is all that's needed to maintain a smooth, easy-to-control glide slope. One thing about airplanes like the UPF—even though they're blind on the runway, the nose is so far down on final that the runway is usually in view until the pilot starts to flair. Then everything disappears.

A strange thing happens in the UPF (and in Stearmans, and Travel-Airs, and...) during landing flair—the world seems to go by in slow motion. As that

(Continued on page 112)

Building a True Airplane

by ART SCHROEDER

BUILDING RADIO-CONTROL model airplanes is a fascinating hobby. And unless one builds "hangar queens" that merely look nice, one ultimately must fly his building project. If one does want to see his undertaking "fly off the bench," the airplane must be true—the fuselage straight, wing and stabilizer square to each other and set at the proper angles, vertical fin square to the stabilizer and top datum line; the engine, too, must be set at proper angles to everything else and flight surfaces can have no warps.

All of this must be carefully checked before flight is attempted. For years, modelers did this checking by various measurements with rulers, sticks and string; it was an uncertain process that took hours of work. Such ritual is no longer necessary because we now have Robart's* Model Incidence Meter (MIM), a device that certainly is a modeler's insurance policy.

The Robart tool consists of an aluminum member that is 18 inches long, and rigid enough to hold two adjustable V-blocks for attachment purposes and a center device that includes a degree meter and a bubble level. Illustration 1 shows how this tool can be effectively used. There's very little in the alignment of a model airplane that can't be checked with MIM. The name Model Incidence Meter may, however, be wrong since incidence is only one area for investigation with this tool.

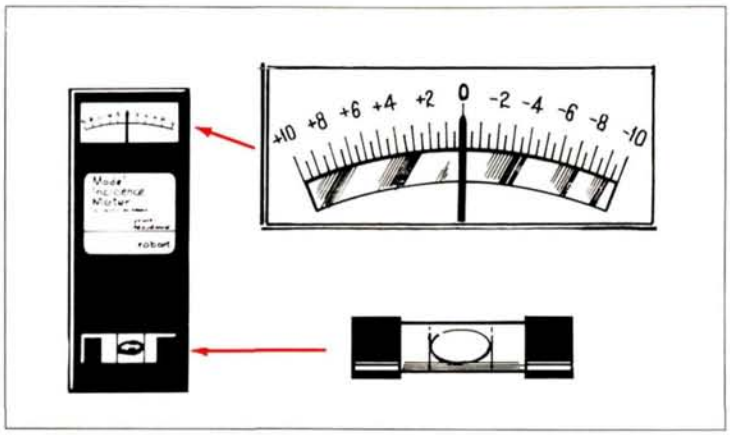


Illustration 1

I've used MIM for years, and the following, also published in pamphlet form by Robart, is a compilation of my experiences with it.

I own three of these tools, enabling me to take three simultaneous readings after the set-up of a datum line. This is particularly helpful when setting up a biplane's two wings in relation to its stabilizer.

The meter has two indicators—a sensitive, weighted pointer that is calibrated in degrees and a bubble level (similar to a carpenter's level). When the bubble is centered in the vial, the MIM is considered to be level (Illustration 1).

The upper, magnified meter scale has a mirror along its lower edge. To take an accurate reading, the viewer must eliminate any chance of parallax error. This requires aligning the reflection of the pointer with the actual pointer so that the reflected image is totally hidden behind the pointer. Readings are taken from the scale directly in degrees, as in Illustration 2.

All uses of the meter relate to leveling a datum line to a flat surface (Illustration 3) such as a workbench (a pool table is great for this). Model plans will show those datum lines and checking the plans usually reveals the designer's intent. The side-view datum line may be the thrust line or the top of the main building member (a crutch or the fuselage side's

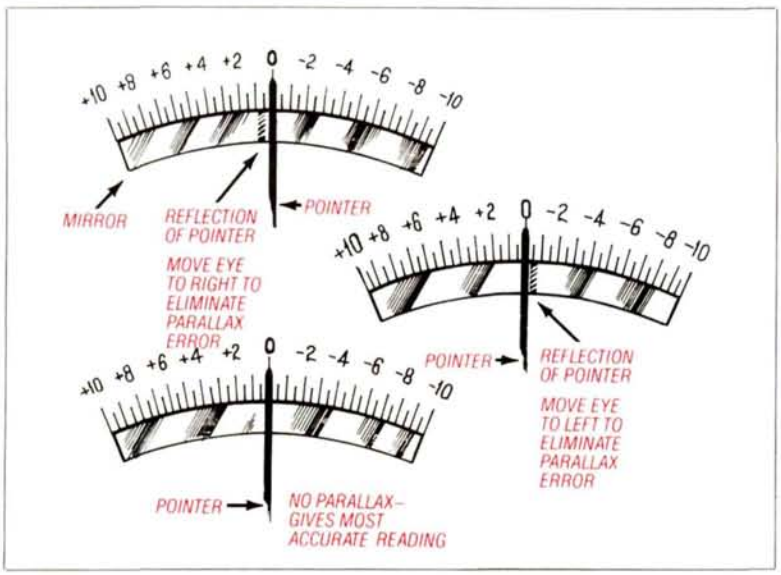


Illustration 2

A Robart Incidence Meter proves to be invaluable help.

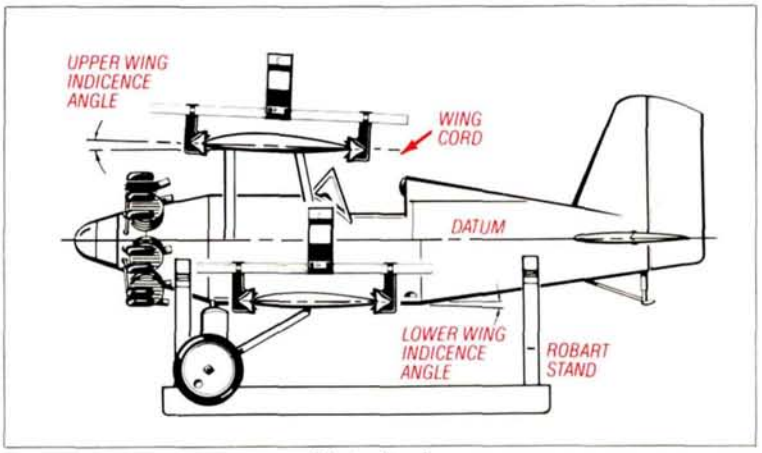


Illustration 3

top line). If you can't determine the designer's datum line, you can establish one that is visually acceptable and set everything to that—it will work. Alternatively, if you know the wing root is set at zero, you can use the meter to set the attached wing to a level position—everything else will follow.

The datum line for the top view can always be considered as the fuselage center line from the nose to the tail.

In any event, the fuselage must be leveled by some method. A Robart Super Stand or blocks of wood placed at the tail while the airplane's axles rest on the bench works well. It is also necessary to weight the fuselage or hold it securely with rubber bands so it won't shift.

It is certain that for various measurements the datum line selected must be parallel to the surface the fuselage is resting on. This can be achieved with the meter's bubble or by measurement.

Level the fuselage and set the MIM on the wing by sliding the V-blocks inward until they gently grip the leading edges. The angle of the wing to the datum line, if the fuselage is leveled, is indicated by the pointer as in Illustration 4. Set the proper wing angle as shown on the plans by shimming the wing saddle. The pivoting V-blocks will automatically center the incidence meter on the wing chord and its 18-inch length will take care of just about any model airplane. Accurate positioning on tapered and elliptical wings will be automatic.

Biplane wings are usually set at differing angles of incidence and the difference between these two angles is known as a "decalage." To determine this, level the fuselage and set the MIM on the lower wing. Set the lower wing incidence as the plans show. Now move the meter to the upper wing and set that angle. If the wings are set at the angles specified on the plan, all will be well. If not, take any necessary steps to rectify the situation. Decalage is determined by subtracting the angle of the wing from the other (Illustration 5).

One thing, don't second-guess your designer. Biplanes have wing settings relative to the stabilizer that can vary a great deal. Use the settings on the plans! If nothing else, you start from the same point as the designer. One of the best biplanes I ever flew was the Cassella/Meli Pulsar that carried its top wing at a negative angle—at best, an unusual approach, but it worked well. Always heed what is shown on the plans since the designer knows best. And the Robart meter will always show if you have those settings in accord with plan specs.

For stability and better low-speed handling characteristics, many wings are built with a progressive twist from root to tip. This twist raises the tip trailing edge and insures that tip-stall will occur later than stall at the root. In effect, this technique reduces an aircraft's tendency to snap-roll in landing position. The twist is known as wash-out.

If your wing turns out to have the reverse situation, wash-in, you probably have a dangerous setup. Some aircraft have no twist at all and one must check the plans to be sure that things are properly arranged.

To check wash-in (or the alternatives), level the fuselage and set the MIM on the wing root; move the device to the tip and take a reading (Illustration 6). If the root reading is +1° and the tip -1°, the total

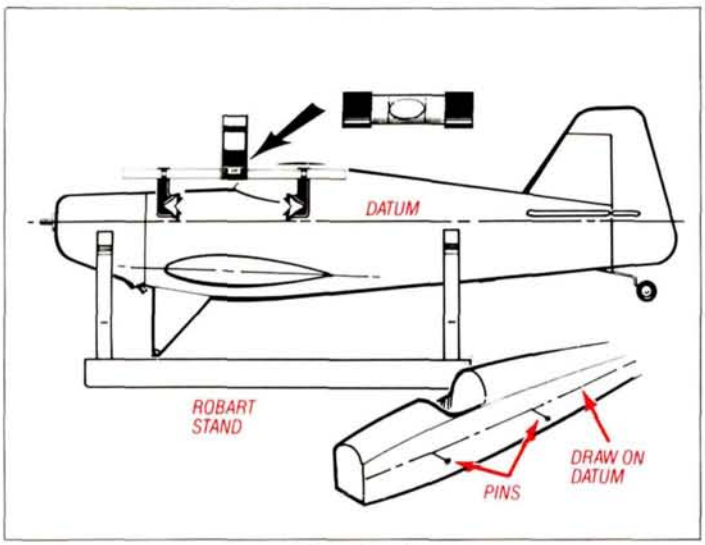


Illustration 4

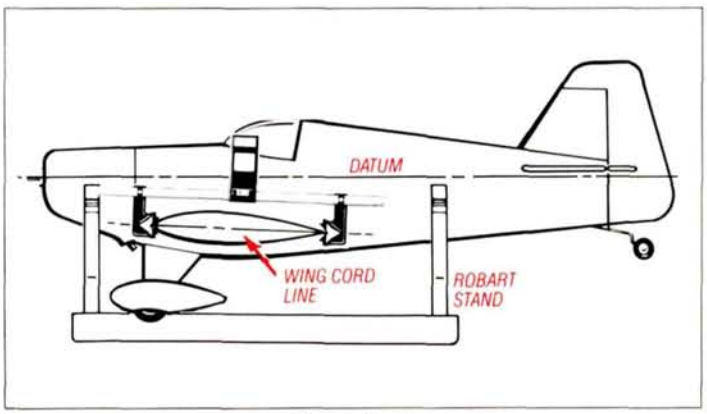


Illustration 5

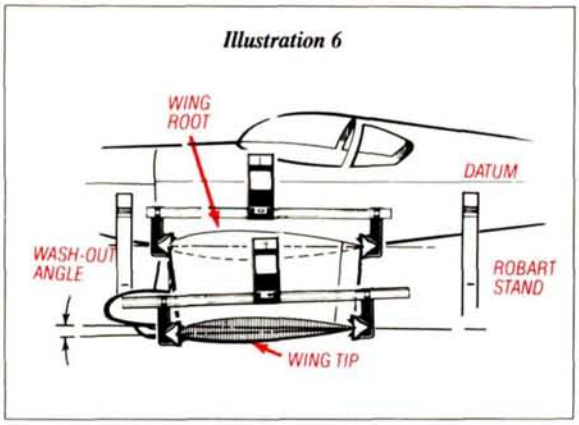


Illustration 6

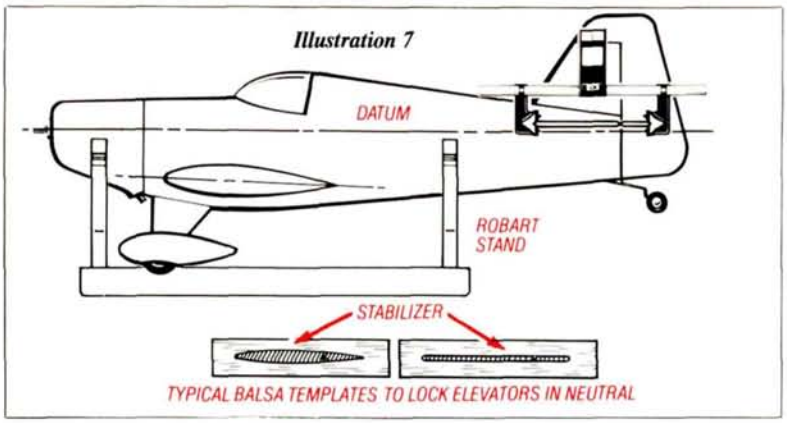


Illustration 7

wing twist, or wash-out, is 2°. If your model has strip ailerons, they must be locked in a neutral position before taking tip readings. Use a simple locking device as shown in Illustration 7.

Stabilizer incidence is as important as any setting on your model. To determine what that angle is, level the fuselage and securely clamp the elevators in neutral. Set the MIM on the stabilizer—Illustration 7 again—using the V-blocks and read the angle on the pointer. The reading may be positive or negative as called for on the plans. Always check the plans for proper setting and shim as necessary to match. Warps on the stabilizer, as on the wing, can be found by taking meter readings at various stations on the flight surface.

The engine thrust line is not always set to point straight ahead; often down-thrust is used; occasionally one even finds up-thrust. The amount of thrust is not a fixed value, but is rather determined by the designer in flight tests to suit the wing/stab angular difference, the CG and the basic aircraft design. Your engine should be set to the angle the designer calls for on the plans (Illustration 8).

To check down-thrust, level the fuselage as in Illustration 9 and using the propeller nut and drive washer, clamp one of the adjustable V-blocks on the prop shaft. A thick wooden washer may be needed to take up the space normally occupied by the propeller. With things in place, the thrust angle will be indicated as either plus or minus by the pointer.

Many models require side-thrust for proper flight trim and, once again, this will be shown on the plans. Usually, the few degrees needed will be automatically built in the aircraft by the firewall setting. To check side-thrust, turn the fuselage on its left side and level it to the datum line (Illustration 10). Secure the fuselage firmly to prevent any shifting. Bolt one adjustable V-block as for checking down-thrust and read the thrust line offset at the pointer. As shown in the illustration, a reading of +2 indicates a right side-thrust of that amount. In this check, there shouldn't be a negative reading!

Both the horizontal stabilizer and wing cannot be tilted relative to each other or the fuselage. To ignore this is to invite an unwanted turning tendency.

To check both wing and stab, level the fuselage making sure the center line is vertical, as in Illustration 11; a right triangle or carpenter's square is useful for this. Place shims under either side to accomplish this.

Set the stabilizer in its place and put the MIM across it as shown in Illustration 1. Use the pointer and bubble to indicate a square condition. Sand, cut, and shim until all is perfect, and then the stab can be glued in place. Leave the meter in place, periodically checking things as the glue sets to insure that nothing has moved.

The wing can be set in the same fashion. Be sure the adjustable V-blocks contact the wing at 90° to the fuselage fore and aft the center line, as in Illustration 12. They must also be equidistant from the fuselage center line.

Since the wing is usually removable, adjustment must be made by shims or sanding. If shims are used, glue them permanently after a squared condition is achieved.

The fin is also a flight surface and it must be aligned with the top-view fuselage center line. However, some fins on

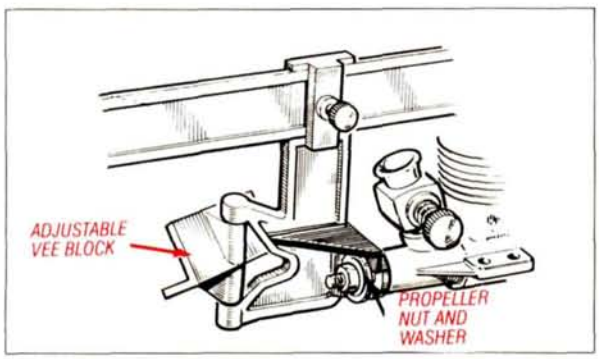


Illustration 8

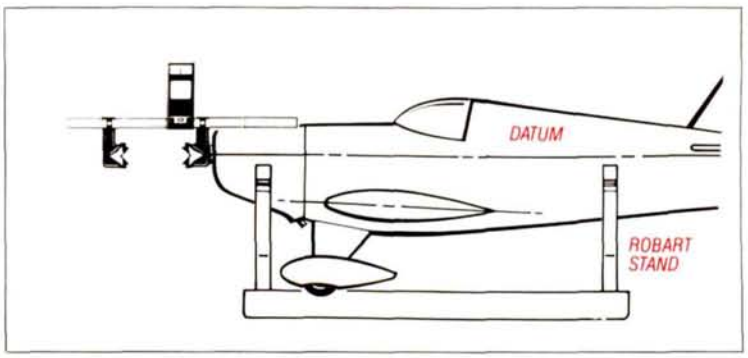


Illustration 9

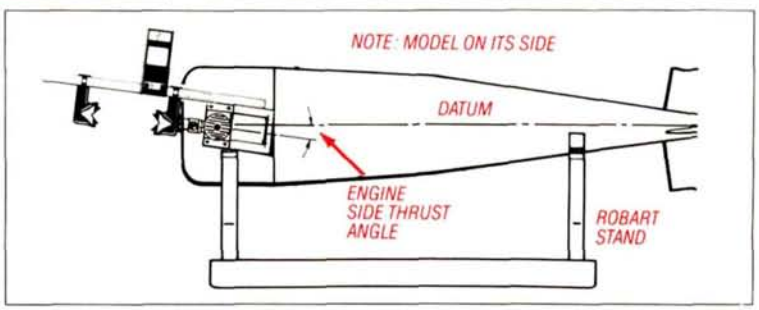


Illustration 10

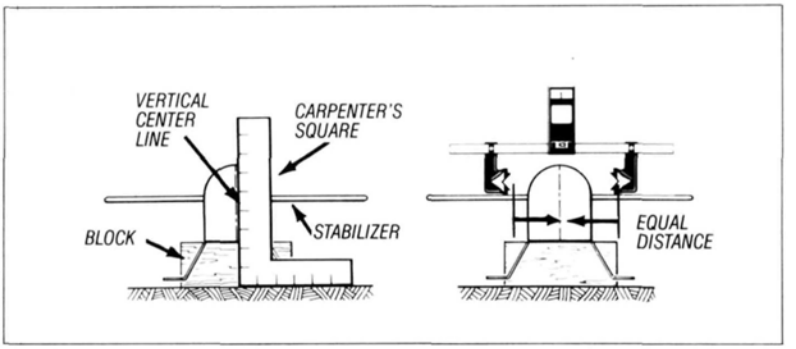


Illustration 11

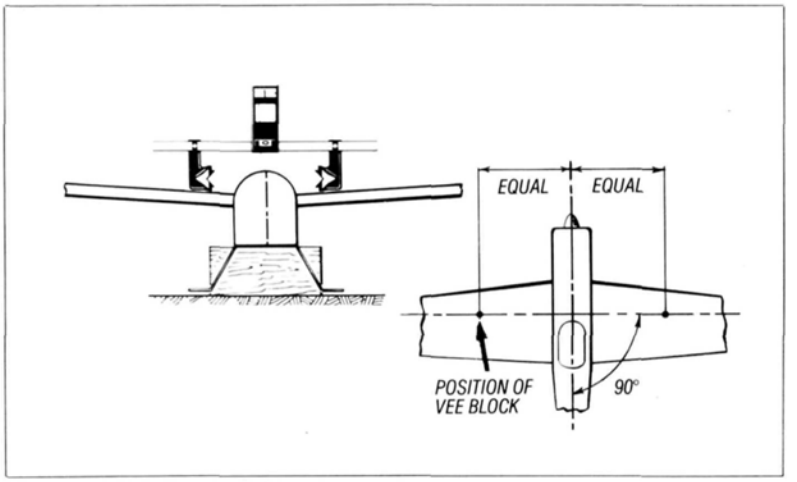


Illustration 12

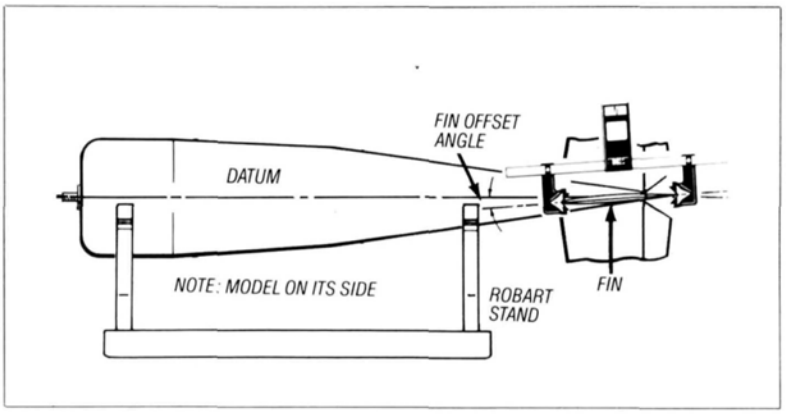


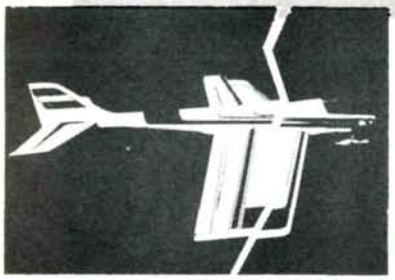
Illustration 13

scale models have an offset to counteract torque. Fins may be checked by turning the fuselage on its side and leveling it to the top-view center line. The MIM is attached to the fin/rudder—lock things in place as with other surface checks and a reading is taken at the pointer (Illus. 13).

The beauty of the Robart Incidence Meter lies in its usefulness both during building and after. One doesn't have to wait for all the glue to set before adjustments are made. Major parts can be held in place with pins, rubber bands or tape, readings can be taken, and adjustments can then be made. The tool is only as limited as its user's imagination. It is both versatile and accurate. One thing is certain, the Robart Model Incidence Meter is a real help toward better model-flying. Give it a try.

**The following is the address of the company mentioned in this article:*

Robart, P.O. Box 1247, 310 N. 5th St., Charles, IL 60174. ■



Repairing ARFs

by RICH URAVITCH

Don't toss that ARF—it can be fixed!

THIS STORY STARTS with my introduction to the Hobby Shack* EZ series of Almost-Ready-To-Fly (ARF) sport-scale airplanes nearly three years ago. Seems a good friend, Joe Molfetta, had bought a Decathlon, decided it was a little too hot for him just then, and decided to let me fly it—a decision of questionable merit! Actually, I put many enjoyable flights on that bird and got very comfortable, a sure sign of impending trouble. Sure enough, showing off one day, I rolled the Bellanca into a little foam, ply, and balsa ball. R/C etiquette being what it is, I told Joe I'd order a replacement for him, collected the bits and pieces of my newly acquired wreck, and shelved them in the corner of my workshop.

When I set out to repair the fuselage (the wing was practically unmarked), I was glad I had collected *all* the recoverable pieces. After locating and marking where the broken pieces went, I started gluing them in place. Any place where foam contact was involved, I used Zap* Z-FP Foam Primer. This allows you to use Zap-A-Gap for repair as if the foam were wood. You'll notice that refitting some of the broken pieces may require bending and twisting of the fuselage. The reason for this is that you'll be reversing the impact which caused the damage to begin with.

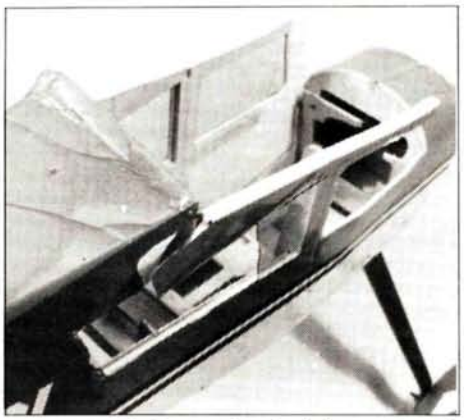
Once everything is in position, some light ply or hard balsa "scabs" will adequately restore sufficient strength to the joints. That should take care of fuselage repair.

I've never been inside an EZ wing before nor had I planned to, but I was out with my brand-new EZ Laser on the first flight...you know the story...little too lean, engine sagging, stiff headwind, trees to clear on final, engine quits, wind intensifies, no place to go, tree becomes hostile—repair wing!

As the pictures show, I removed as much of the skin (foam) as I thought necessary to uncover all the potential damage. The foam is just about 1/8-inch thick so I decided to replace it with 1/8-inch balsa. Thinner balsa could be used but a ledge would have to be built up to flush-surface the balsa with the foam. After upper and lower skins are installed, trim the forward edge to accept the appropriate size balsa stock for a leading edge. Now protect the area around the cut-out with masking tape. Carve and sand to final shape. The repair can then be recovered with an iron-on that either matches or complements the existing finish. The low-temp materials might be slightly better suited for this application as there is less risk of overheating the foam skin of the original covering.

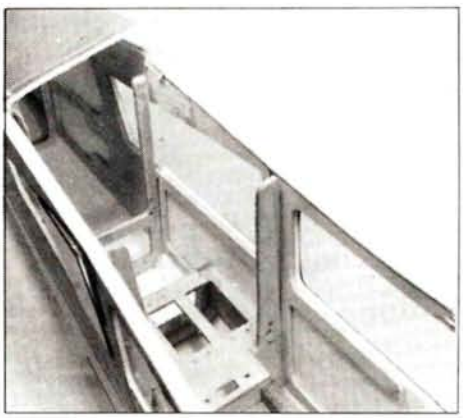
Do a balance check of the wing to make sure your repair didn't add excessive weight to one side. It shouldn't have, but if it did, a slight amount of weight in the opposite tip won't hurt.

The entire wing repair to my Laser took about two hours total, consumed less than $5 in balsa wood and covering material and had me airborne again quickly...not to mention the new EZ I can

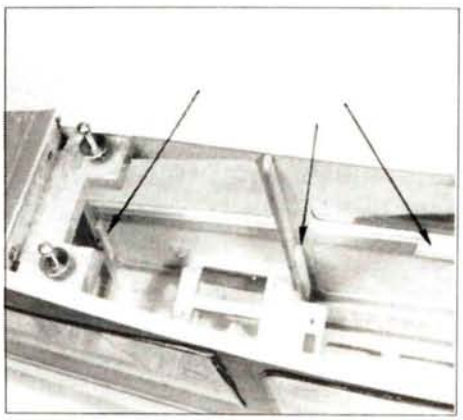


I started with fractured and missing parts and torn skin. Lots of damage, but repairable.

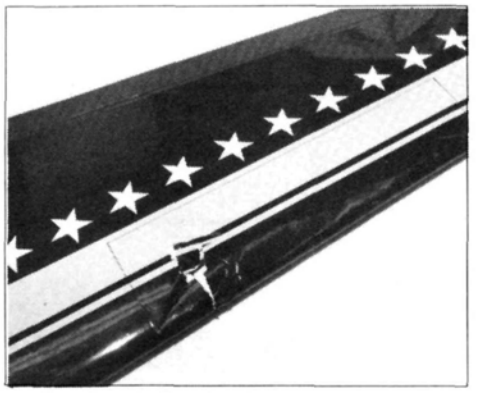
Key to repair is saving as many broken pieces as you can find. They will fit back together.



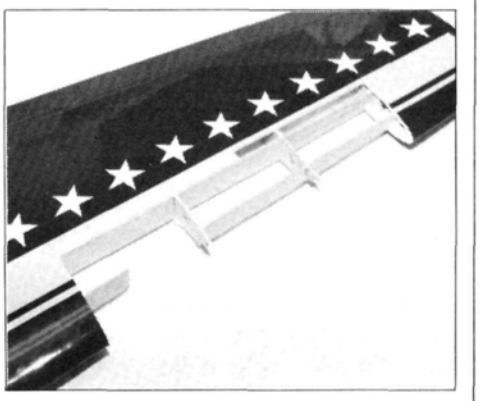
More fuselage damage with separated formers. In most cases, glue can be squeezed into the cracks.



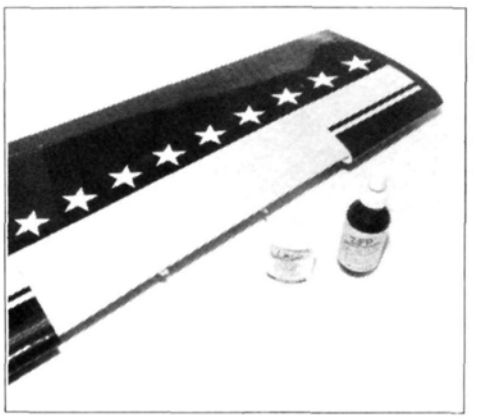
All glue joints have been completed and ply scabs have been added for reinforcement.



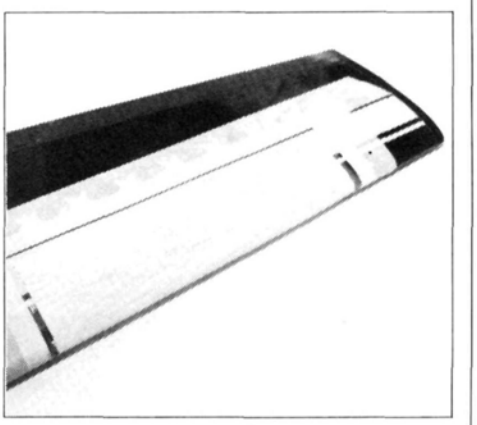
A.



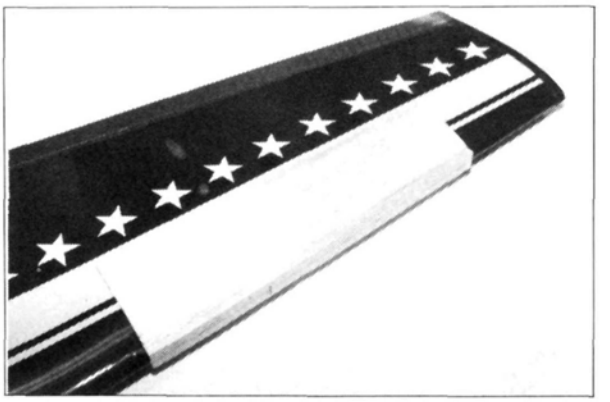
B.



C.

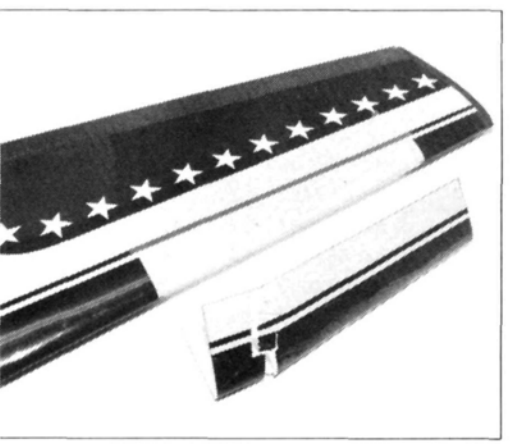


E.



D.

A. First mark directly on wing area of damaged structure to be repaired. B. Remove foam skin and repair broken parts with balsa. C. After shaping, cover with ⅛-inch balsa sheeting. Zap Foam Primer and Zap-A-Gap work great here. D. Balsa upper and lower skins in position and bonded in place, along with leading edge. E. Mask perimeter, leaving ⅜ inch border, to prevent surface scuffing during shaping and sanding. Sand to match existing shape. F. Repair completed and MonoKoted, almost like new.



F.

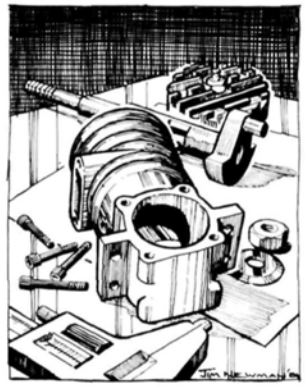
buy with the money I saved!

These repair techniques are applicable to most any current generation of almost-ready-to-fly kits, including those with foam wings. After the anger wears off from your crash, it's rarely as bad as it looks. And now aren't you sorry you threw that slightly damaged Pitts in the club trash barrel?

**The following are the addresses of the companies mentioned in this article:*

Hobby Shack, 18480 Bandilier Circle, Dept. HM047, Fountain Valley, CA 92728-8610.

Zap: From Pacer Tech, 1600 Dell Ave., Campbell, CA 95008. ■



About Those Engin

by JOE WAGNER

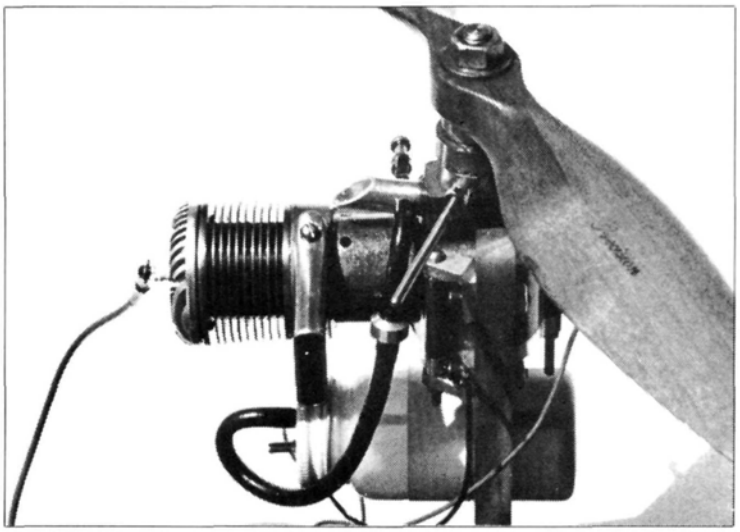
THIS YEAR marks my 50th anniversary since first getting involved with model airplane motors. It hardly seems possible, but I've been experimenting with the little rascals now for one quarter the age of the U.S. Constitution! I've learned a lot in all that time. But one thing I've especially learned is that I don't know all the answers about model engines.

Take the problem of engine corrosion, for instance. Some modelers are plagued with it; others never see it. It appears to affect ball bearings the worst, and many theories have been advanced as to what causes it. Some authorities claim it's due to moisture in the fuel. It's true that methanol does absorb water when exposed to humid air yet moisture alone can't be the culprit. I have a model airplane carrying trailer with wire-spoke wheels I built myself, using standard model-engine ball bearings. This trailer has been used many times in rainy weather, but there's not a trace of rust on any of the bearings.

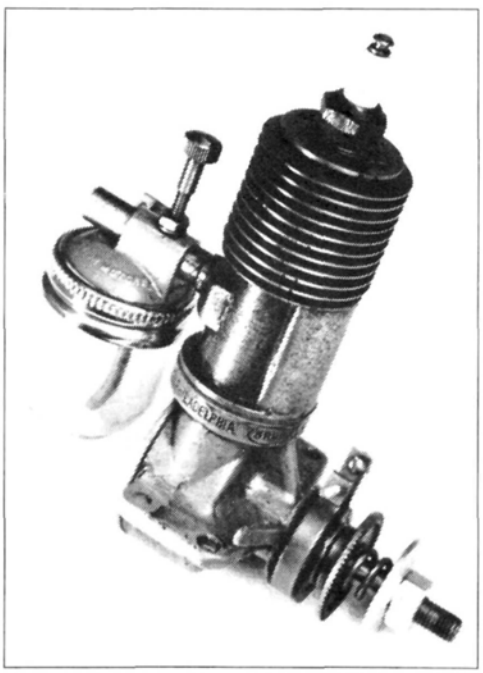
Another theory suggests that methanol may at times be contaminated with acid, and that's what rusts the bearings. I believed this myself until recently, because I know that methanol is a by-product of formaldehyde production. If obtained from this source, it can contain a little formic acid. But I've discovered that formic acid acts as a rust *preventer* rather than a rust producer.

Then there's the notion that nitromethane decomposes with time or exposure to light, forming nitric acid in the process. This probably does happen, but often I've used old glow fuel with no corrosion problems at all. In any event, if nitric acid does get into a model engine, it will attack the aluminum parts before it will the steel components.

This occurs once in a while, but it is uncommon. However, once I soaked a particularly cruddy OK Cub .15 in a jar of wood alcohol and when I pulled it out a few hours later, the whole backplate had been eaten away. Because of its lower cost, modern fuel manufacturers use reclaimed methanol at times, but I'm sure that none of it has detrimental acid content. It may contain colored dye or even perfume if it's reclaimed from soap or cosmetic manufacture, but no significant amount of corrosive acid.



Orwick .64 is today's most widely available replica spark ignition engine. Its $200 price is equivalent to the $32.50 it sold for in 1946.



The author's very first engine, a 1937 Brown Jr. Restored to its original configuration, it runs fine.

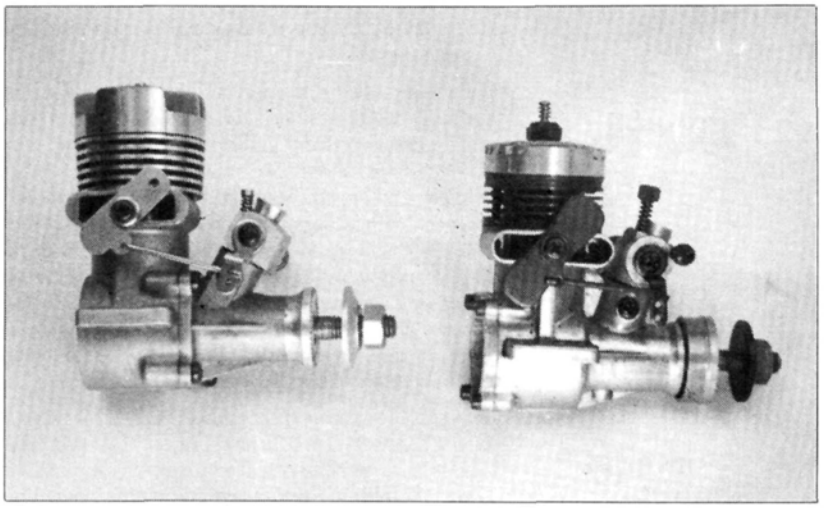
What does cause ball bearings to rust in our model engines? I think it's a combination of several things. First, the steel that ball bearings are made from is hard, high-carbon steel. And the higher a steel's carbon content, the more sensitive it is to rusting. Second, the recent trend toward clean-burning model fuels with their synthetic lubricants and detergents seems to coincide with the rusty ball bearing problem. Since 1946 I've owned many model engines with ball bearings, and have never found rust in any of them—but I've never used glow fuels with nothing but synthetic lubricant.

Castor oil is messy. It can bake onto the fins of your model engine an ugly, dark-brown, sludgy coating that's extremely difficult to remove. It sprays out the exhaust and onto your model with a pervasive, greasy, film that nobody likes. But it will protect the ball bearings against rust!

I think that rust is caused by moisture and acid in the fuel, but not in the way that's been suggested. I believe that small amounts of moisture combined with minute traces of acid produce what's called a "galvanic corrosion" in ball bearings. The tiny concentrations of car-

bon in the steel form a sort of microscopic battery circuit with the iron molecules. Acidic moisture in contact with this acts as an electrolyte, resulting in an electrical current. Small as it is, it acts to combine oxygen with the iron and produces rust.

This can't happen, however, if the steel is surrounded by a greasy coating that excludes moisture and oxygen. My trailer bearings don't rust because they're smeared all over with lithium grease. And the glow fuel I use with castor oil and no detergents similarly covers my model engine ball bearings with a protective film. Sure, it's difficult keeping my engine exteriors clean, and I need to wipe oil off my models a lot, but I don't ruin any motors from ball bearing rust.



The previous generation of R/C motors got smooth response and low idle speed from coupled barrel throttles and exhaust restrictors. Enya .19, left, and O.S. Max, right.

As with most things in life, working with model airplane motors involves compromises. To gain one advantage you usually have to give up something else. The choice is up to you.

Now let's talk about connecting rods. Recently there has been an upsurge of connecting rod failures in model airplane engines, and modelers are wondering what's causing them.

The connecting rod is one of the least understood and appreciated parts of a model motor. Everyone is concerned about piston-cylinder fit, compression ratio of the head, crankshaft porting, and so on, but the lowly connecting rod is just something that's in there to attach the piston to the crankpin and make it harder to take the engine apart or put back together again.

In truth, the connecting rod is the hardest-working part of the motor! Consider this: in each revolution of the propeller the engine's piston comes to a complete stop, and reverses direction, twice. Can you appreciate how often that occurs? Drop a coin from 6 inches onto a tabletop. It falls fast: from the instant you let it go, until it strikes the table, only 30 milliseconds elapse. In that same time, a model engine running at 12,000 rpm has started and stopped its piston twelve times.

On the upstroke, the compression of the fuel-air mixture cushions the piston's motion like a shock absorber. But at the bottom, the connecting rod has to take the full impact. At 12,000 rpm that's 200 pounding blows every second.

High running speeds do more than just multiply the number of times the connecting rod has to stop the piston's downward motion. They also add greatly to the force of impact. Since the mechanical energy of a moving object is proportional to the square of its velocity, a one-pound weight falling to the ground at 16 ft. per second strikes four times as hard as it would at 8 feet per second. Falling twice as fast doubles the momentum; and the object has to come to a stop twice as quickly too.

This rapidly increases the stress on the connecting rods at high rpm. My old Brown Junior has a long, slender rod with a cross-section smaller than you'll find on a modern .15. The Brown was designed to run about 9,000 rpm maximum, and its rod held up very well. A modern FSR .15 is often operated at 18,000 rpm and more, thus stressing its rod four times as much as the Brown's—even though the Brown has four times the displacement.

Sure, connecting rods have been accidentally under-designed, and have failed under normal use. The Ohlsson .29 of 1949 was badly afflicted with this problem, and it led to the breakup of what was once the largest model engine manufacturing company in the world. But most engine designers are well aware of the loads and stresses that connecting rods are subjected to. They don't design them for unlimited running speeds, however.

Again we return to the theme I've expressed in earlier installments of this column: high running speeds are bad for model engines. Of course, I'm not writing for racing competitors or other high-rpm fanciers. I like to fly models just for the sheer fun of it. And although I appreciate a well-performing model as much as anyone, I don't want to ruin my engines. And I know that I don't need high rpm for good performance. Thrust is what flies the airplane, not how fast the crankshaft spins. A large-diameter prop will deliver more thrust at moderate speeds than a motor that's shrieking its life away on a tiny propeller.

Some engine experts advise you to make your prop selection on the basis of the horsepower curve of your engine, that is, you look up the test data and see that your engine peaks its output at 17,500

(Continued on page 112)

TOP GUN!

Applying iron-on covering can often turn into a real shootout. That's where **Royal's Heat Gun** and **Heat Iron** can easily even the score. Both are engineered to handle the wide range of coverings on the market today—and do so with ease!

A word to the budget minded, however: owning the *Top Gun* doesn't mean you have to pay *top dollar.* On the contrary, both the **Royal Heat Gun** and **Heat Iron** are priced to burn the competition—not shoot holes in your budget. Ask for them by name at your local dealer today.

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ROYAL HEAT GUN

ROYAL HEAT IRON

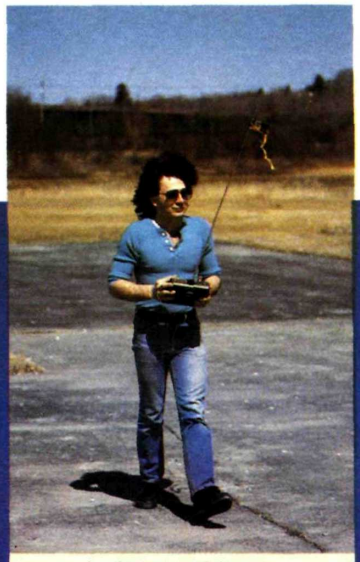
CONSTRUCTION. A few notes about the kit are in order. These models require a little more work than some other ARFs, but they do give you the choice of finish and are reasonably priced, too. The biggest difference is that these planes require the modeler to do the hinging and covering. If you're getting tired of cookie-cutter models swamping the field, it's a big plus. The covering job isn't too onerous, since it involves only the relatively flat wing and stab. Like some other imported kits, the translated instructions are a little obscure, but read them anyway; they're helpful. Fortunately, because 75% of the building is already done for you, this isn't a problem. The full-size plans are the most professionally drawn that I've ever seen and they'll answer most questions at a glance. Based on the quality of the parts and method of construction, these should be some of the most durable models around.

Begin construction with the wing and stab. Since they're quite similar in design you might as well work on them at the same time. The balsa trailing edge must be added to each wing half and the stab. I used PIC* Foam Treat in conjunction with PIC-Stic Slow Cure cyanoacrylate. I've used many of PIC's extensive glues with excellent results. The barn-door ailerons and the elevator must be cut from the sheeted cores with a sharp knife or a small saw. There are routed-out grooves to guide this job which make it quick

(Continued on page 88)

Type: *Trainer Sport*
Wingspan: *67 inches*
Length: *48 inches*
Wing Area: *653 square inches*
Weight: *5 pounds, 14 ounces*
Engine: *.40 to .45 two-cycle*

photos by LOUIS V. DeFRANCESCO JR.



Aviomodelli CESSNA 177

The precision Italian ARFs are here!

by STEVE SCOTTO
and CHRIS CHIANELLI

UNLESS YOU'RE from the dark side of the moon, you must have noticed how common the initials ARF have become. In fact, these three letters are as ubiquitous in model aircraft ads as "state of the art" is in electronics. Most all, these planes do the job well, are fun-flying and fast building. For plenty of R/Cers, they're becoming the aircraft of choice.

There's now a new kid on the block, Aviomodelli of Italy. Distributed by United Model Products, this line features a range of semi-scale and sport planes offering plenty of value in a quick-building package.*

Let me explain the Aviomodelli version of ARF. The foam-core wing and stab are flawlessly sheathed in obeechi, a hard, tough, tight-grain veneer. The fuselage is a blow-molded plastic monocoque. That's high-tech jargon meaning the skin carries all the flight loads, and no framework is necessary. A few plywood parts, and a very complete hardware package round out these well-crafted, high-quality kits.

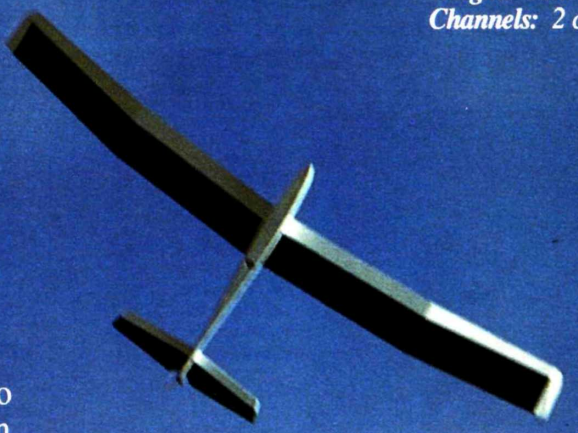
The kit I built is a stand-off scale version of the popular Cessna 177. Visit any local airport and you're sure to find plenty of examples of this popular training, pleasure, and workhorse aircraft. Aviomodelli has taken liberties with the scale outlines and moments for better flying.

R/C soaring made easy.

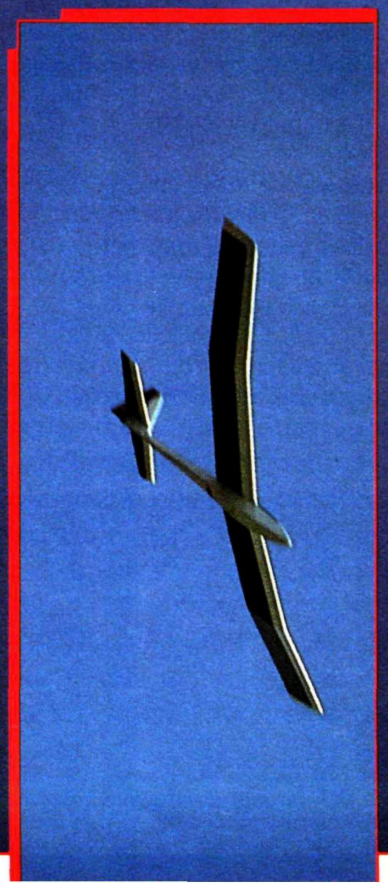
Top Flite
WRISTOCRAT

by PETE YOUNG

Wingspan: *56.25 inches*
Area: *335 square inches*
Weight: *10.5-13 ounces*
Channels: *2 channels with mini servos*



THE WRISTOCRAT is Top Flite's* candidate for the recently formed R/C Soaring Class A event—for sailplanes with a 60-inch wingspan or less. Although hand-launched thermal duration competition has received the most publicity in recent years, the Academy of Model Aeronautics* (AMA) also sanctions Class A competition in Slope Duration, Distance, Altitude and Speed—the AMA's 1987 Competition Rulebook contains full details.

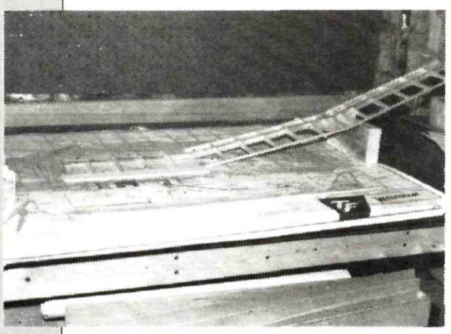


In addition to competition, the Wristocrat is also ideally suited to good old-fashioned fun flying in smaller flying areas where it may not be feasible to string out electric winch or high-start lines. A very appealing concept, and the major reason for my building the Wristocrat. Only a minimum amount of equipment is needed to enjoy the grace and beauty of controlled soaring flight.

With the 60-inch wingspan limitation, the Wristocrat's design emphasis on an aerodynamically clean structure capable of hand-launching to efficiently search out the weaker thermal activity typically found at low altitudes. With these objectives in mind, my first impressions upon inspecting the kit were very favorable. Design features of the Wristocrat include a D-tube wing with the proven Eppler 205 airfoil, a full-flying stab mounted up out of the wing's downwash, and low moments of inertia. A large "finger hole" on the bottom of the fuselage provides a secure grip for accurate hand-launches. I was also impressed with the kit engineering: the plans and the instructions were thorough, and the wood selection and die-cutting were excellent.

photos by HANK WOODRUFF

Perdue's Mary Schmitz with a lovely airplane. Wristocrat may be flown as a hand-launched glider or as a high-start glider.



Setting wing polyhedral is done most accurately with elevation blocks.

The Wristocrat kit also includes a small free-flight, hand-launched glider for youngsters to build. I subcontracted the building of this to my nine-year-old son, who will report on this himself.

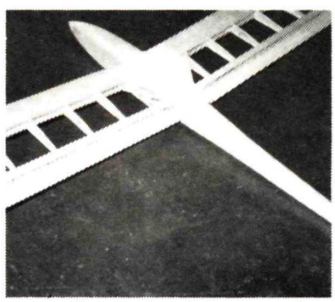
Back to the big Wristocrat. I was intrigued to find a recommendation to incorporate edge flaps on the inboard wing panels, a feature not normally found on small gliders. After some thought, I decided to add flaps to my Wristocrat. The primary reason was that a small amount of reflex flap (flaps "up") should allow the glider to be thrown faster and higher than a comparable non-flapped ship. My hypothesis was that the reflex flaps would allow the Wristocrat to accelerate faster in a low-drag configuration, versus having to trim-in the down-elevator to counter high-speed pitchup. This benefit has to be balanced against the weight of the flap mechanism and a third servo, of course, but I was willing to try it—and, as flight results proved, the flaps work very well!

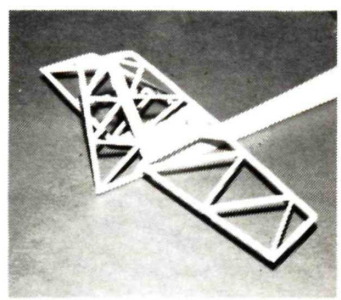
CONSTRUCTION. With the help of the excellent instruction book, construction of the Wristocrat proceeded smoothly without any significant problems. The wing is a straightforward D-tube with 1/8x3/16-inch spruce top and bottom spars; wing attachment to the fuselage is via an 8-32 nylon bolt at the trailing edge and by a hardwood dowel at the leading edge. The slight modifications required for flaps are well explained in the instructions and illustrated on the plans. The fuselage is primarily balsa with lite-ply formers. Control actuation of the rudder and elevator is by thin, .06-inch-diameter, flexible steel cable-rods, a nice touch. Overall weights should be carefully controlled due to the glider's small size, but this shouldn't pose any problems for a builder who has built one or two airplanes.

I used Pacer's* Zap line for strength and speed. I chose to finish the airplane's surfaces with Top Flite's Super MonoKote in white and charcoal; the trim stripe was stripped from some surplus black Super MonoKote. The fuselage was finished with two thin coats of sprayed white K&B* Superpoxy.

I made several minor changes during construction. Rather than actuate the flaps with a cable-rod running to externally mounted horns, I used Carl Goldberg* ½A strip aileron fittings to rig the flaps; benefits included an all-internal installation, direct pushrod drive to the flaps, and adjustable control throws. I also used carbon-fiber

(Continued on page 104)





The simple but strong structure of Wristocrat is evident as Derek Young works. All basic construction is well within the skills of most novice builders, yet sufficient to retain the interest of experts. Performance is outstanding.

Nine-year-old Brett Young built the tiny Wristocrat. He's proud!

WHEN MY DAD got the Wristocrat radio-control glider to build, I was happy to see that the kit included a small hand-launched glider for me. We have built several hand-launched gliders together, but this was the first one that looked like a radio-control sailplane.

The wood pieces were die-cut and color-printed a nice blue on the edges. They were easy to punch out.

I followed the instructions without trouble. I sanded the tail pieces thin to save weight, and sanded the wing pieces to a good airfoil. After sanding, I bent the wing pieces over small ribs to form a better gliding airfoil. My dad helped me with the dihedral angles and the gluing. The fuselage halves were glued together and the edges sanded to make nice round corners.

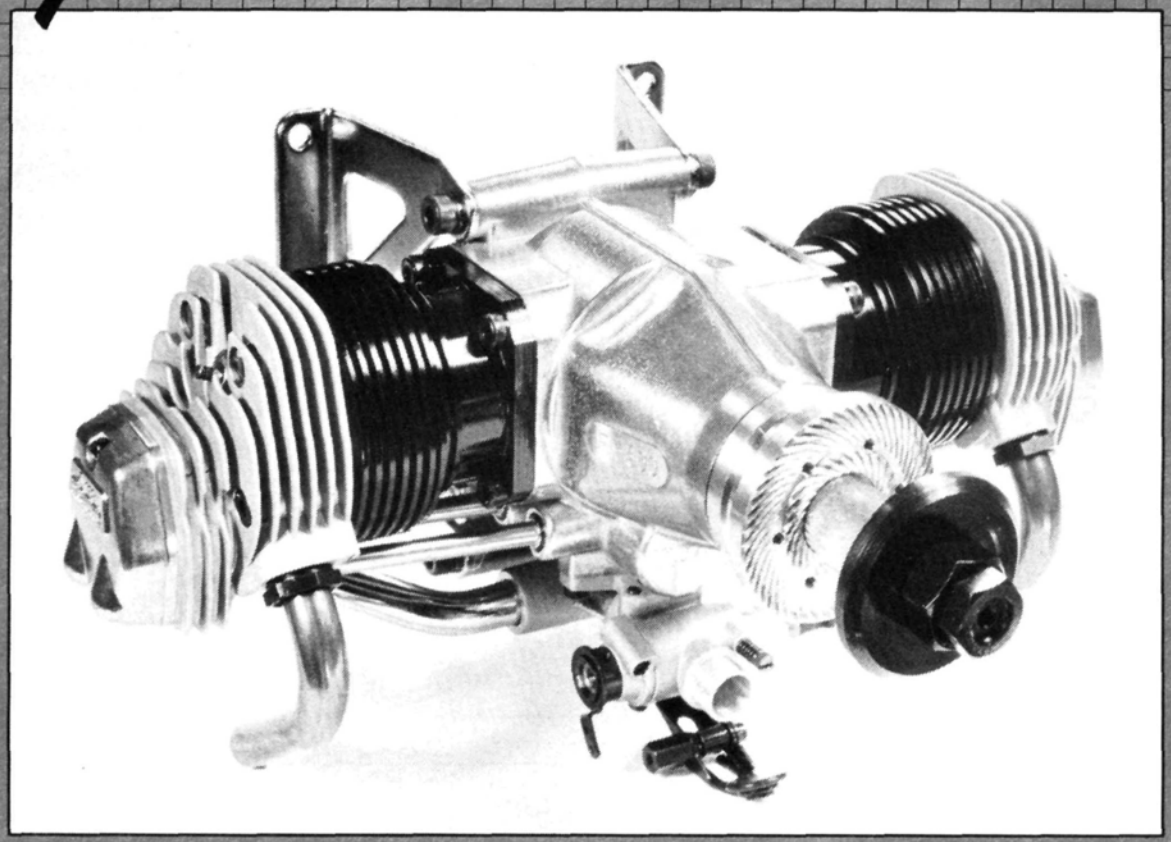
The Wristocrat was easily built in two short evenings.

Clay was supplied for noseweight; but it doesn't stick well in the cold. I taped a small bolt to the nose with masking tape, and added small bits of tape for fine balance. The plane was balanced as the instructions suggested.

The glider first flew at a field in Manassas where radio-control gliders fly. It was a little windy, but not too bad. The glider really climbed well on a hard throw. On the third flight I threw it hard—it climbed up, recovered, and put in the longest flight of the day, over half a minute.

Building and flying the Wristocrat was fun! ■

Engine Review Round-Up



O.S. Super-Gemini "300" Twin

by PETER CHINN

SPECIFICATIONS

Type: Air-cooled, horizontally-opposed, twin-cylinder, alternate-firing, four-stroke-cycle, with pushrod operated overhead valves.
Bore: 33.6 mm (1.323 in.)
Stroke: 27.5 mm (1.083 in.)
Displacement: 48.77cc (2.976 cu in.)
Nominal Compression Ratio: 7.8:1
Speed Control: Single O.S. barrel-throttle adjustable automatic mixture control carburetor.
Checked Weights: 1.98 kg (4.36 lb) including firewall mounting brackets; 1.82 kg (4.0 lb) less mount.
Mounting Dimensions:
Overall width: 241 mm
Overall length from prop driver face (less firewall mounts): 124 mm
Overall length from prop driver face (including firewall mounts): 148 mm
Bolt hole spacing (firewall mounts): 90x90 mm
Manufacturer's Claimed Power Output: Not stated
Manufacturer: O.S. Engine Mfg. Co. Ltd., Higashisumiyoshi-ku, Osaka 546, Japan.
U.S. Distributor: Great Planes Model Distributors Company, P.O. Box 4021, Champaign, IL 61820.

THE EVER-EXPANDING O.S. four-stroke-cycle engine range now numbers a round dozen different models, neatly split into six single-cylinder and six twin/multi-cylinder units.

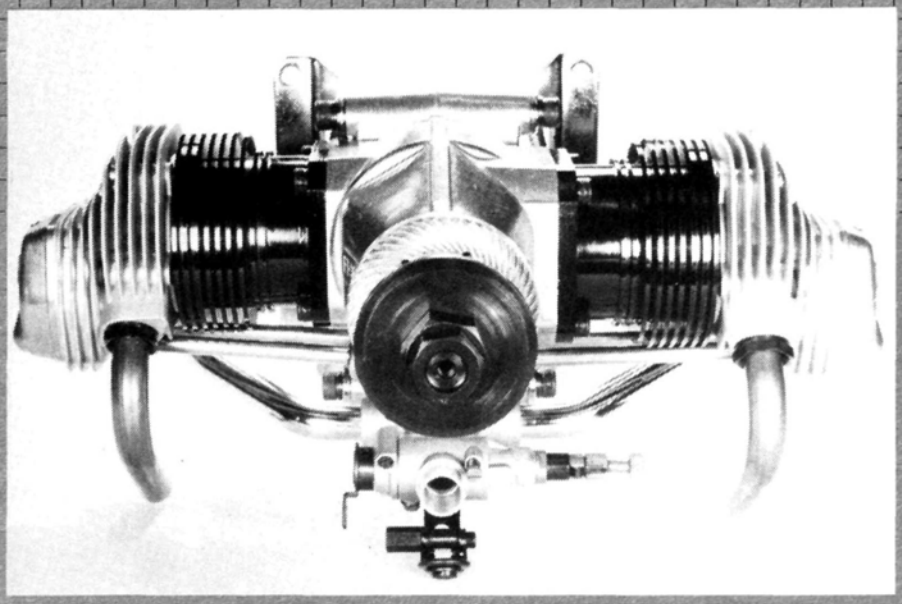
The six singles, ranging from the 0.22 cu in. FS-20 to the 1.2 cu in. FS-120, all have the prefix letters "FS" identifying them as "Four-stroke, Single-cylinder." The four "FT" ("Four-stroke Twin") models range from the 1.2 cu in. FT-120 Gemini to the 3.0 cu in. FT-300 Super-Gemini. The line-up is completed by the splendid 2.4 cu in. FF-240 ("Four-stroke, Four-cylinder") Pegasus recently featured in our *M.A.N.* test series, and by the impressive 3.0 cu in. FR5-300 ("Four-stroke, Radial, Five-cylinder") Sirius.

The FT-300, or Super-Gemini 300, is the latest addition to the range. Basically, it is an enlarged displacement version of the Super-Gemini 240. In this respect, it follows the pattern established with the Gemini-160 which bears a similar relationship to the Mk.II version of the Gemini-120. This was a very successful development, as our *M.A.N.* test report on the Gemini-160 demonstrated (see October 1985 issue) and there seems to be every prospect that the Super-Gemini 300 will find an equally ready acceptance

among scale buffs looking for a civilized powerplant for the larger type of model.

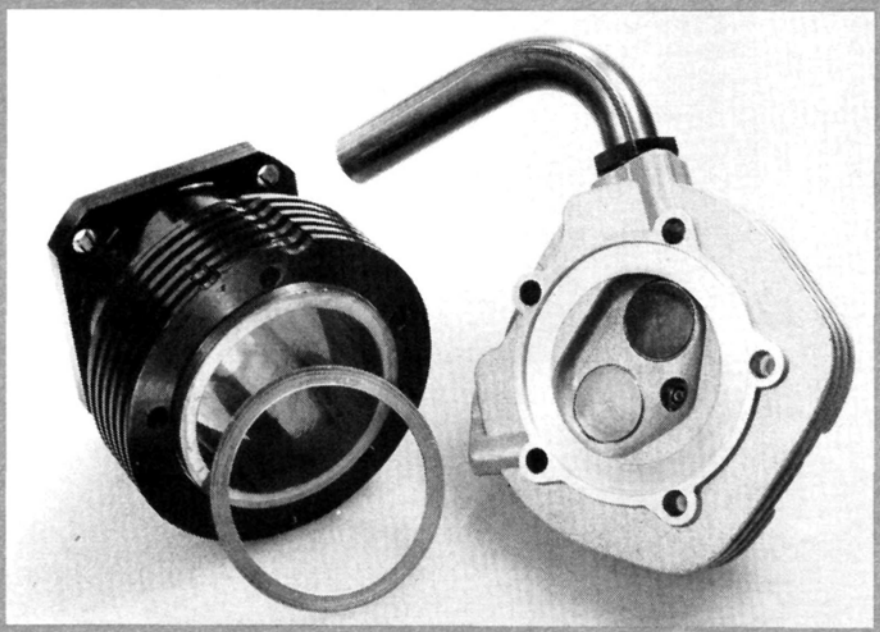
With the Super-Gemini 240, which was introduced two years ago, O.S. deliberately set a displacement limit of 40cc, choosing a bore and stroke combination of 30.4x27.5 mm to produce an actual swept volume of 39.92cc or 2.436 cu in. One does not know whether it was anticipated that an enlarged displacement version might be offered at a later date, but certainly the design of the engine was such that expansion could be accomplished without difficulty. The FT-240 is a sturdily built engine weighing 4.42 lb and has been well able to accommodate an increase in cylinder bore of 3.2 mm (just over ⅛ in.) with no increase in external dimensions or weight. As the data table shows, the Super-Gemini 300 checked out at 4.36 lb and has a displacement of 48.77cc or just under 3.00 cu in.

The actual increase in displacement, of over 22 percent, can be expected to substantially improve torque—sufficient to increase top-end prop speed by, perhaps, 400-500 rpm or, alternatively, to allow the use of increased prop diameter and/or pitch.



Superior balance of Super-Gemini's flat-twin layout offers smoother running qualities than single-cylinder engines of similar displacement.

Externally, the new engine is identified by the "FT-300" engraved (in place of "FT-240") on the crankcase nose, but it is otherwise difficult to tell the two apart unless one has them side by side. Examination then reveals that the Gemini 300 not only has larger diameter cylinder jackets, but also a slightly different crankcase and backplate. Other, less visible, new or modified parts include the cylinder heads, cylinder-liners, pistons and rings and valve assemblies.

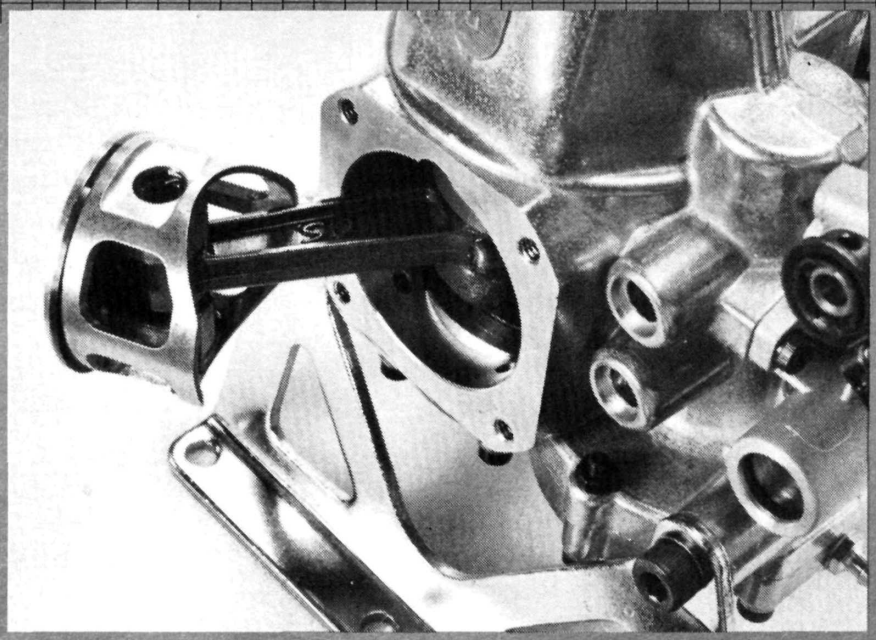


Super-Gemini 300's cylinder and head assembly. One-eighth inch increase in cylinder bore has enlarged displacement by 22%.

For the benefit of readers unfamiliar with the O.S. Gemini series engines, it may be appropriate to conclude this short coverage with a brief run-down on the structural features of the FT-300.

Starting with the crankcase, this robust aluminum casting contains a hefty one-piece two-throw crankshaft that is supported in three large ball journal bearings, two at the front and one at the rear. Beneath the crankshaft and spur gear driven by it, the camshaft is also carried in all bearings. At the front end, the crankshaft is equipped with a big 1¾ inch diameter machined aluminum prop driver that is locked to the shaft with a Woodruff key. Prop security is taken care of by a special O.S. safety locknut assembly.

Special lightweight slipper pistons are fitted to the Gemini 300. As with the other current Gemini models, these are coupled to drop-forged bronze connecting-rods with, of course, detachable lower bearing caps. The pistons run in hardened steel cylinder liners that are fitted into machined, black-anodized, aluminum alloy finned jackets secured to the crankcase with socket head cap screws. The pressure cast finned cylinder heads are tied down with five socket head cap screws and feature a modified bathtub shaped combustion chamber like most other current O.S. four-stroke motors. The vertical valves operate in the usual phosphor-bronze combined guides and seats and are opened by cast steel rocker arms. The overhead valve gear,



Super-Gemini 300 employs new ultra-lightweight slipper-type pistons. Forged I-beam section bronze connecting rods are featured by all current O.S. Gemini models.

readily accessible for valve clearance adjustment, is contained in rocker boxes which have the usual neat O.S. covers. The pushrods are also enclosed, of course.

The carburetor is a barrel-throttle adjustable automatic mixture control type with forward facing intake and a self-reopening choke valve. It plugs into a pressure cast inlet manifold that is bolted to the bottom of the crankcase and from which mixture is conveyed to the cylinder heads via chromium plated inlet pipes. The exhaust pipes are the usual O.S. stainless steel type.

In common with the FT-240 (and unlike the smaller FT-120 and FT-160 models, which have cast aluminum mounts) the 300 is supplied with a pair of very strong plated-steel firewall mounting brackets. As with all the O.S. twin and multi cylinder power units, the engine itself is readily detachable from the mount, enabling it to be conveniently removed from the aircraft for servicing or storage. Other welcome touches are the easily installed control extensions for the needle-valve and choke, and the wiring leads with excellent snap-on glowplug connectors.

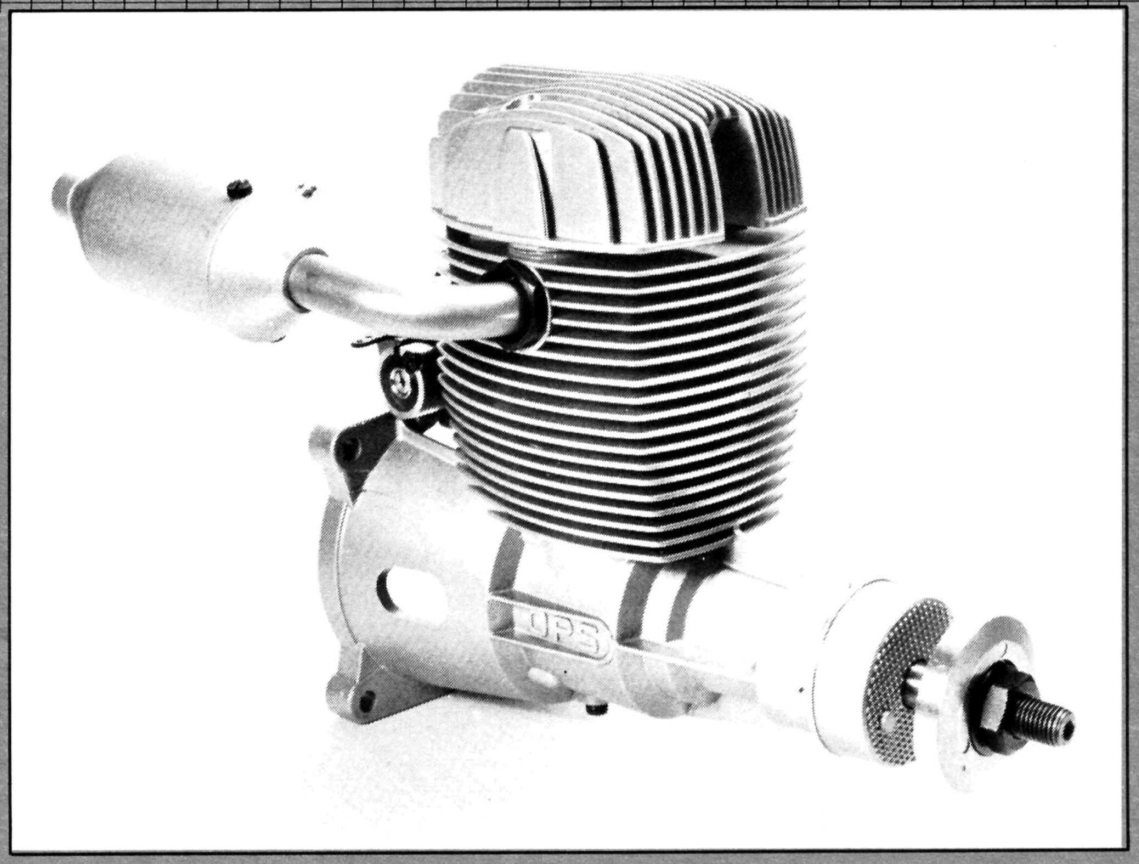
As befits a large and expensive piece of merchandise, the Gemini 300 comes in a handsome black and gold case, approximately 11x10x6½ inches, that also contains all the tools and accessories necessary for operating and servicing the engine. These, in addition to the items already mentioned, include a chrome finished drop-forged 14/17 mm box-ended wrench for the prop and exhaust nuts, a set of hex keys and small wrenches, a set of mounting screws, lock washers and blind nuts and a valve adjusting kit.

With its smooth power delivery and subdued engine note, the Super-Gemini 240 model has the reputation of being a most impressive and desirable substitute for the typical chainsaw-engine based single cylinder two-strokes with which large-scale enthusiasts are familiar. The Super-Gemini 300, with its added attraction of improved power output and a better power/weight ratio, should be equally well received.

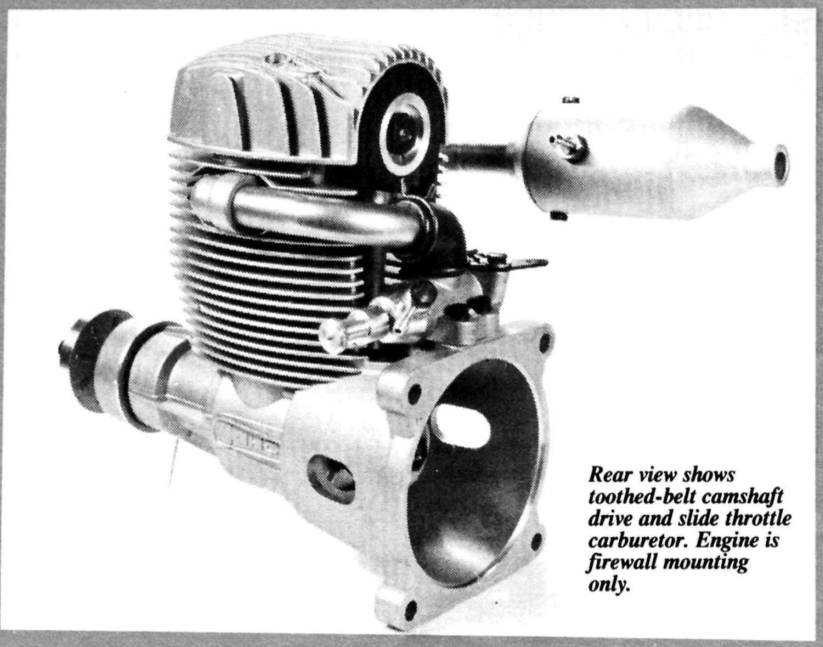
Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

Engine Review Round-Up

by PETER CHINN



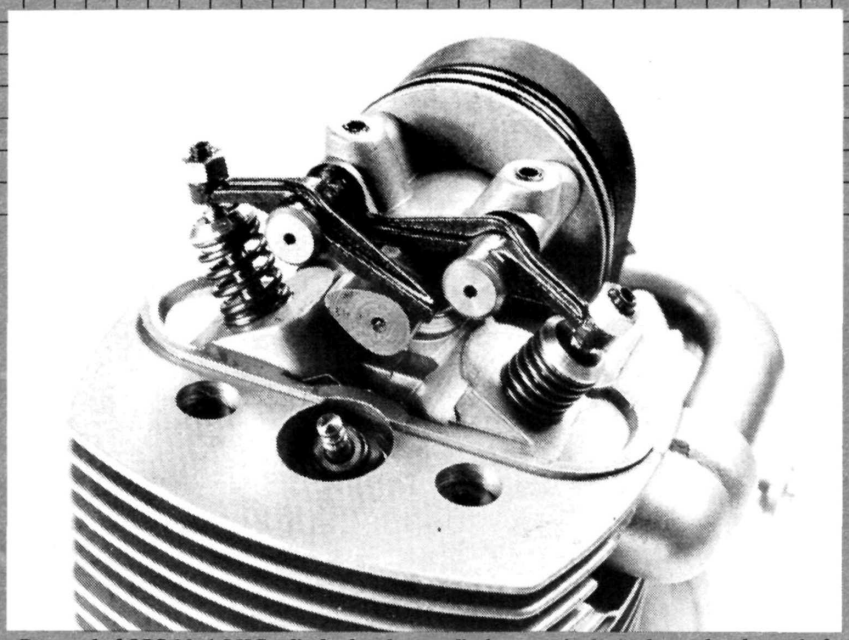
OPS 20-4 OHC



Rear view shows toothed-belt camshaft drive and slide throttle carburetor. Engine is firewall mounting only.

SPECIFICATIONS

Type: Air-cooled, single-cylinder, four-stroke cycle with toothed-belt driven single overhead camshaft.
Bore: 32.0 mm (1.260 in.)
Stroke: 24.5 mm (0.9646 in.)
Displacement: 19.704cc (1.202 cu in.)
Measured Compression Ratio: 7.3:1
Speed Control: OPS slide-throttle type carburetor with adjustable automatic mixture control.
Checked Weights: 1,063 grams (37.5 oz) less muffler; 1,097 grams (38.7 oz) with muffler.
Mounting Dimensions:
Crankcase width: 71 mm
Length from prop driver face: 142 mm
Height above CL: 112 mm
Bolt hole spacing: 60x60 mm
Manufacturer's Claimed Power Output: 2.1 bhp at 12,000 rpm.
Manufacturer: OPS s.r.l., 20041 Agrate Brianza (MI), Italy.
U.S. Distributor: Shamrock Competition Imports Inc., P.O. Box 26247, New Orleans, LA 70186.



Removal of OPS 20-4 OHC cylinder head cover discloses engine's single overhead camshaft, two rocker arms, and inclined valves.

THE ITALIAN OPS company has been famous for high-performance model two-stroke-cycle engines for nearly twenty years and it is not immediately obvious, especially when viewed from a frontal aspect, that this new OPS motor is not just a largish two-stroke motor. It even appears to bear a slight family resemblance to the big OPS 30 "Maxi" two-stroke. No rocker covers or pushrods, that would indicate a four-stroke, are visible.

But then you notice the high positioned, small diameter exhaust pipe and the inlet pipe on the opposite side and the half-hidden toothed pulley and belt at the back.... Another European rotary-valve four-stroke? Not so. The OPS 20-4 OHC (and the clue is in that "OHC") has conventional poppet valves, but they are operated by a single overhead camshaft.

In the full-sized i.c. engine world, overhead camshaft engines come in many types but, especially in the past, they have been associated mainly with high performance applications, such as racing and high quality sports cars. We do not have the space, here, to describe all the different types of camshaft and valve operating gear (*this information will be found in the author's recent* M.A.N. *book* Model Four-Stroke Engines—*Publisher*) but, very briefly, they can be divided into SOHC (single overhead camshaft) and DOHC (double overhead camshaft) designs.

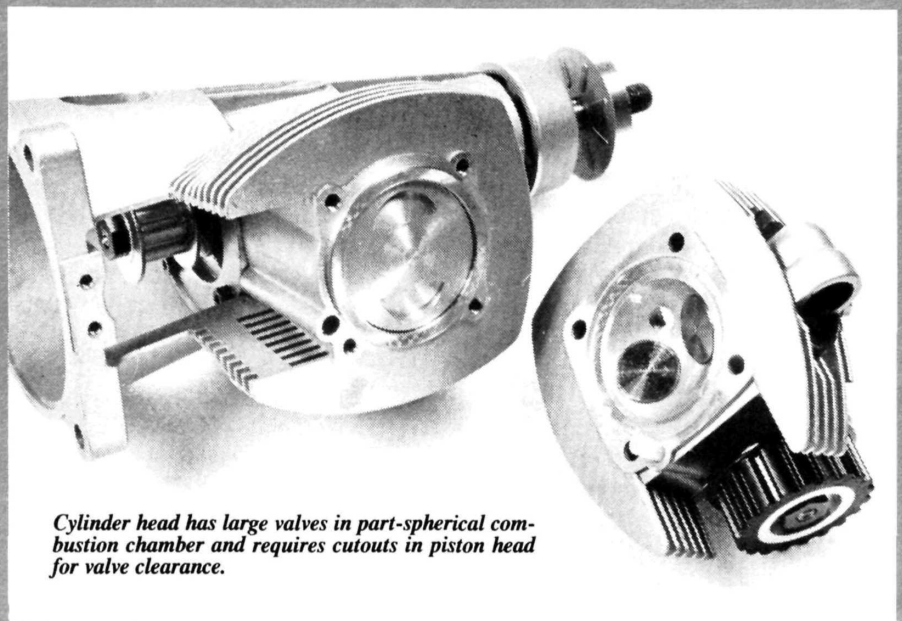
The DOHC engine in which two camshafts, placed side by side, above the cylinder head, operate inclined valves in hemispherical (two valves per cylinder) or pent-roof (three or four valves per cylinder) combustion chambers, is the classic arrangement. The camshafts can be positioned so that the cam lobes are immediately above the valve stems and act directly on them, separated only by a suitable lifter or tappet to eliminate valve-stem side-thrust.

A hemispherical (more correctly, part-spherical) or pent-roof combustion chamber, by facilitating the use of inclined valves, enables large valve areas to be used. A conventional SOHC engine in which the valves are in-line does not have this advantage. However, inclined valves can be used with a single camshaft, by employing rocker arms between the camshaft and valve stem and this is the arrangement used by the OPS 20-4 OHC.

In the OPS, the valves are inclined at an included angle of 60° and even though the 32 mm diameter of the actual cylinder bore is reduced to a combustion chamber diameter of 29 mm, the part-spherical surface of the chamber has enabled two 14 mm diameter valves to be accommodated.

The cylinder head assembly comprises two diecast components: the head proper and a large vertically finned cover. The head itself contains the roller bearing mounted camshaft and also provides support for two fixed rocker shafts. It is tied to the main casting with four 4 mm cap screws. The vertically finned cover encloses the valve gear and also surrounds the upper part of the camshaft pulley. The rocker shafts are located above, and to each side of, the camshaft. They carry large cast-steel rocker arms which have the usual screw adjustment for setting valve clearances.

(Continued on page 114)



Cylinder head has large valves in part-spherical combustion chamber and requires cutouts in piston head for valve clearance.

Control Tower

by CHARLIE KENNEY

THIS MONTH I have the pleasure of bringing you another fine radio system, the Cirrus Wave 5 RC-5JK five-channel FM system from Hobby Shack*. This is a high-quality radio at a very realistic price. The handsome transmitter is constructed of black and brushed silver plastic and employs Mode II stick configuration. The set as received consisted of the RC-5JK transmitter, CR-217 narrow band seven-channel receiver, three CS-238 servos, Ni-Cd transmitter and receiver packs, type-C switch harness, HS-FBC-8B(6) charger and frequency flag, servo mounting hardware and trays, and a neck strap. The particular Cirrus Wave 5 system I received for evaluation operated on channel 48, 72.750 MHz, yellow/gray frequency flag.

Let me enumerate some of the new Cirrus Wave 5 systems features:

Hobby Shack's Cirrus RC-5JX Wave 5 front panel. Transmitter has black plastic and silver bezels and an ergonomic design.

RC-5JK TRANSMITTER

- Robotic component insertion and soldering provide the utmost in quality and consistency of manufacture.
- Stick assemblies are adjustable both in length and spring tension.
- Servo-reversing switches are provided for all five channels.
- Hi-tech type transmitter feels good and is easy to handle.
- Dual-rate switch settings are adjustable on the transmitter front panel.
- Square transmitter output level meter is easy to read.
- Neck strap is provided for those who prefer it.
- Vari-Trim Throttle system allows trim of idle setting without affecting the high throttle setting.
- Nickel Cadmium (Ni-Cd) battery pack.
- Eight-section 37-inch long telescoping antenna provides good radiation efficiency.

CR-217 FM RECEIVER

- Narrow bandwidth ceramic filter allows use of R/C channels only 20 kHz apart.
- Custom integrated circuits used in both the IF and Decoder for minimum package size.
- Improved solderless connectors require little or no maintenance.
- Smart squelch circuit holds servo position when momentary interference occurs.
- FM mode aids in minimizing most man-made noises.
- Through-the-hole-plated fiberglass printed circuit board insures solder joints which are more immune to vibration failure.

CS-238 SERVO

- Long life precision motor.
- Proven indirect drive sealed potentiometer is vibration resistant.
- Custom ICs for high torque and superior neutral accuracy.
- Fiberglass reinforced PBT (polybutylene terephthalate) injection-molded servo case is strong and fuel resistant.
- Strong polyacetal resin precision gears provide smooth operation and almost zero backlash.
- Through-the-hole-plated fiberglass printed circuit board is immune to vibration.
- Improved rectangular servo grommet reduces vibration effect on servo.
- Splined output shaft allows easy adjustment of the servo arms.
- Compact size allows use in many models with limited space.

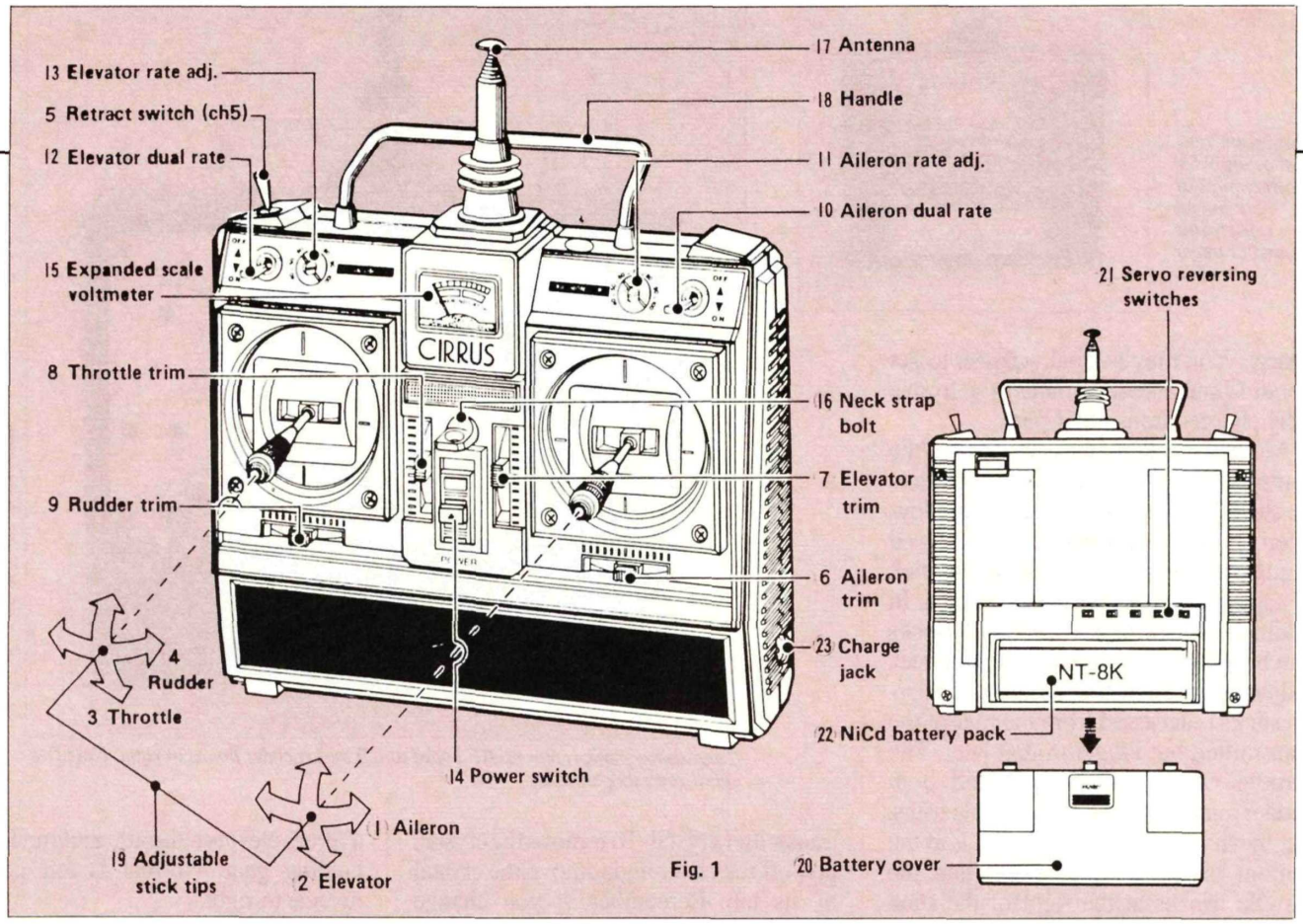


Fig. 1

In addition to the hardware data, the RC-5JK has a six-page instruction manual describing each system element with many drawings and isometric views. The transmitter and airborne system isometrics are particularly good.

The heart of the Cirrus 5JK is the Mode II transmitter, so let's start our review there. At the top is an eight-section 37-inch long telescoping whip antenna located in the center of the transmitter top and behind it is a convenient ¼ inch diameter carrying handle measuring some 4 inches wide and 1-inch high. The channel 5 switch is also located at the left side of the transmitter top. This is an On/Off switch that can be used for landing gear or some other auxiliary function. Directly below the telescoping antenna we find the rather large calibrated output level meter measuring 1 inch wide by ¾ inch high. It is very easy to see. The level meter is equally divided into calibrated red and silver sections. With a full charge, the indicator needle is three-quarters into the silver section. As the transmitter is used, the needle will drop. When it is close to the red side of the indicator, it's time for a

RC-5JK TRANSMITTER

Configuration: Two stick/5 functions with servo reverse on all five channels
Frequency: 72 MHz only
Modulation Type: FM Pulse Proportional Modulation
Power Requirement: 170 mA/9.6 volts
Size: 7.0x6.8x2.2 inches
Weight: 1 pound, 13 ounces

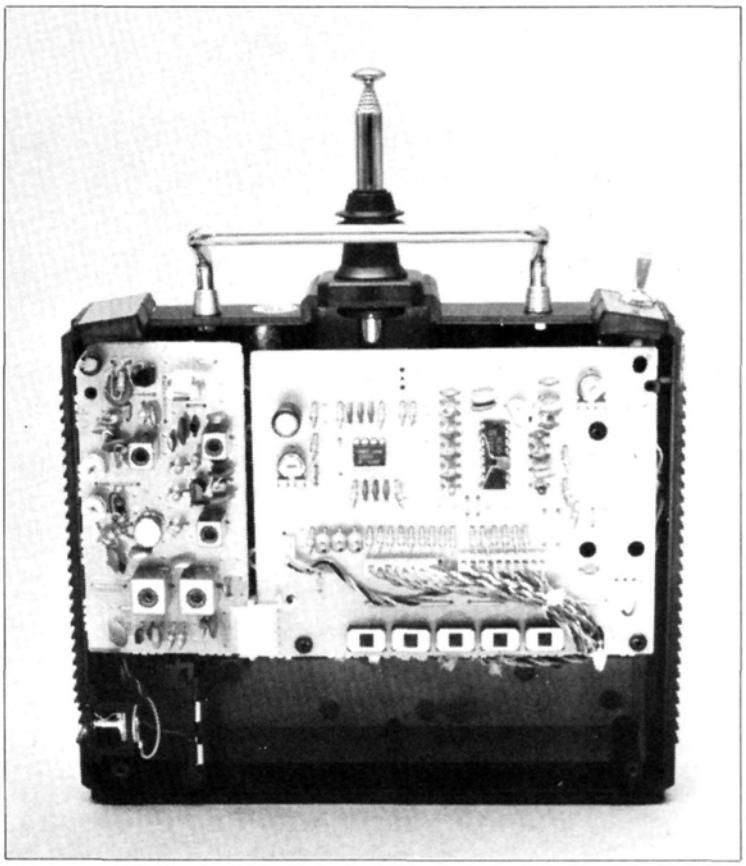
CR-217 RECEIVER

Type: Single Conversion FM-PPM
Channel Spacing: 20 kHz
Frequency: 72 MHz only
Power Requirement: 4.8 V DC at 13.5 mA
Size: 1.38x2.42x0.8 inches
Weight: 1.55 ounces

CS-238 SERVOS

Pulse Width: 1.52ms positive pulse width control
Operating Voltage: 4.8
Current Drain (Idle): 6.4 mA at 4.8 V DC
Torque: 49 ounce-inches
Speed: .23 sec./60°
Size: 1.6x1.6x0.8 inches
Weight: 1.5 ounces

Transmitter rear showing 9.6V battery pack at bottom and replaceable crystal at upper left.



photos by ACE PHOTOGRAPHERS

Transmitter back removed. RF board at left and encoder board at right. Note five servo-reversing switches.

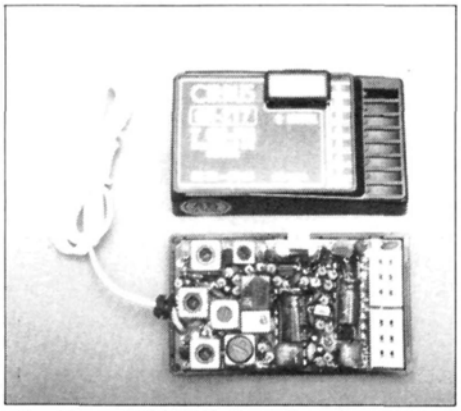
charge. You may normally expect to get about 1 hour and 40 minutes or so from a fully charged transmitter pack.

Moving back to the left side of the transmitter, there is the rudder and throttle stick. The Cirrus radio series employs open gimbal construction that is well made with smooth action. Also, the stick is adjustable in length, about ¼ inch. In addition, the spring tension on the sticks can be adjusted to the user's desired feel. Adjustment of elevator, rudder, and aileron sticks is accessed from the rear of the transmitter, but I'll get to that later. The throttle control is detented and both rudder and throttle have electronic trims, not mechanical. The rudder trim is at the bottom under the stick bezel and the throttle trim is at the right of the stick bezel. In the center of the transmitter is a neck strap bracket and under it is the On/Off switch. Up is on, down is off. Incidentally, the neck strap is provided as an accessory. Continuing to the right is the elevator-aileron adjustable stick with electronic trims, elevator trim to the left and aileron below the stick. On the lower right side of the transmitter (as viewed from the front) is the transmitter charging jack.

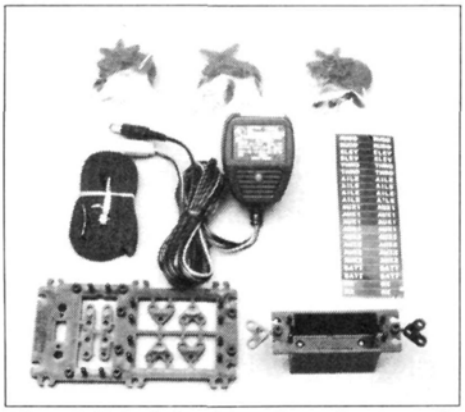
Moving to the transmitter rear side at the upper left is an access cover to the transmitter crystal. To remove the crystal, pop off the cover and remove the crystal by its tab. Remember, if you change frequency, both receiver and transmitter crystals must be changed. At the bottom rear is a removable battery cover, which slides down to reveal battery and servo-reversing switches. The battery may be removed by lifting the right end of the battery toward you. Tightly fitting spring clips are used to connect the battery to the transmitter electronics so there is no soldering to connect a new battery—a nice feature. Located above the transmitter battery pack are the four servo-reversing switches, left to right they are aileron, elevator, throttle and rudder, and landing gear. Normal is left position, reverse to right.

To adjust the spring tension on rudder, aileron, and elevator, the transmitter back must be removed by unscrewing the four Phillips-head corner screws. This will reveal two PC boards. The one to the left is the transmitter RF board and the right the encoder. They are joined by a 5-pin connector at the lower common side of each board. To expose the aileron-rudder adjustment screws, the RF board must be disconnected by gently pulling it to the left. Only the connector holds it in place

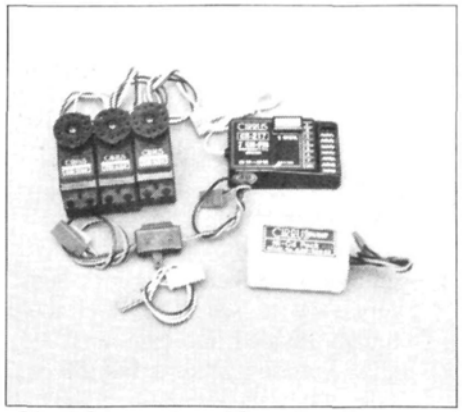
(Continued on page 102)



The Cirrus CR-217 7-channel receiver is very compact; 20 kHz selectivity.



Accessories include servo mounts, charger, neck strap, and spare servo horns.

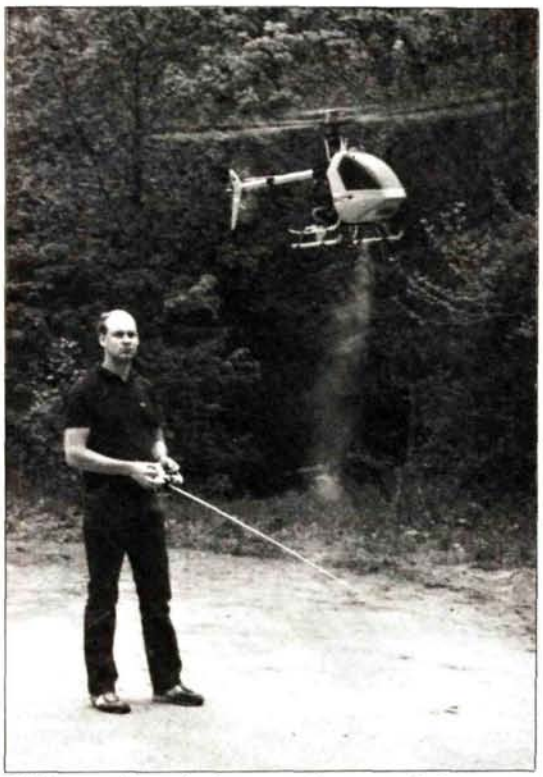


The airborne system with receiver, three servos, 500-mAh Ni-Cd pack, and switch harness.

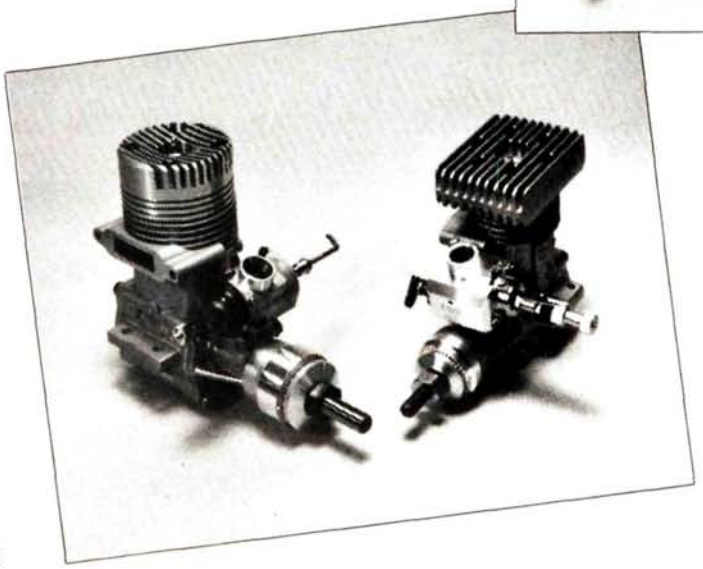
Tuning Helicopter Engines

Understanding how these engines differ from model airplane engines is the secret.

by PAUL TRADELIUS



While assembly and subsequent adjustment of a helicopter engine are imperative to successful flight, the proper adjustment of the carburetor for effective idle, smooth transition, and good top end is of equal importance.



There are numerous carb styles used in modern helicopter engines, but all follow sensible adjustment procedures. See text.

THE ENGINES we use in our helicopters are the same as those used in airplanes except that some are modified with a larger heat-sink head for better cooling and a different carburetor for better mid-range operation. However, adjusting an engine in an airplane is quite a bit easier than adjusting one in a helicopter because the airplane engine can be operated throughout its entire rpm range while holding on to the model. In a helicopter, we have to make an adjustment and then bring it into a hover (or fly around) to see if the mixture is right.

Before we get into the tuning process, I can't overemphasize the importance of safety when operating near a helicopter with a running engine. I've seen pictures of people checking their engine by holding on to the tail boom with one hand while bringing the helicopter into a hover with the other. This is extremely dangerous and should never be attempted by anyone. Always bring the rotor blades to a complete stop before any adjustments are attempted and then stand well clear as the engine is brought up to speed.

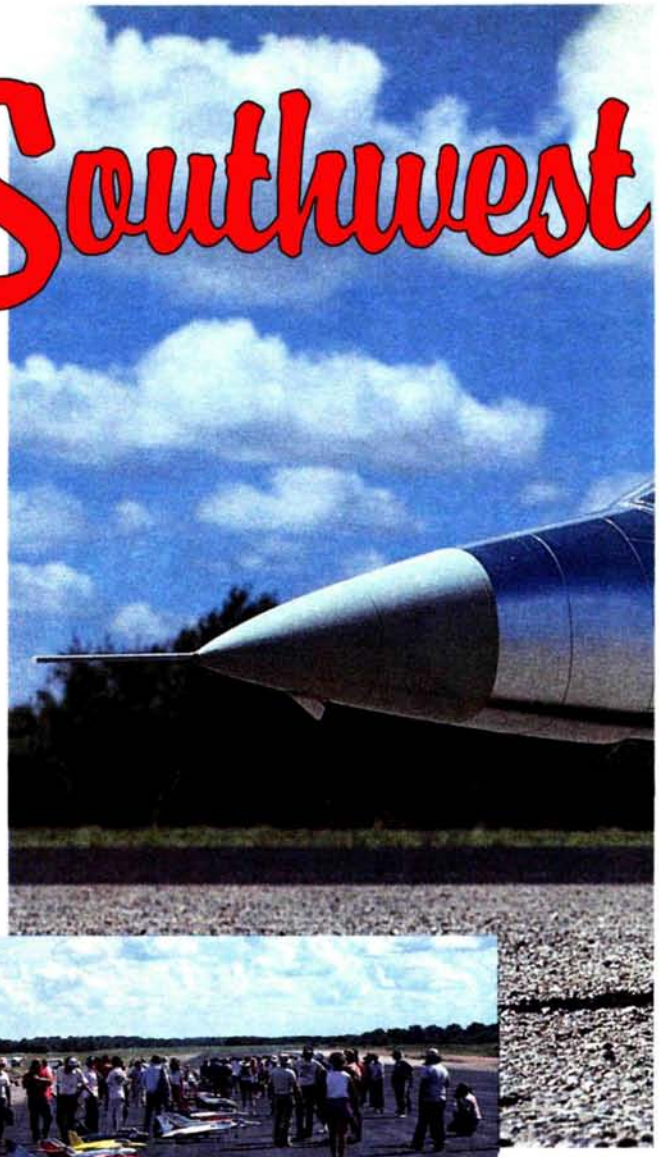
If you have a brand new engine, it's always best to bench-run it according to the manufacturer's instructions. This will not only give the new parts a chance to wear in, but will give you the opportunity to make initial mixture adjustments. However, if you don't have the facilities to bench-run your engine, it's perfectly acceptable to mount it in your helicopter and break it in during flight. This is possible because the engines made today require a lot less break-in than those of several years ago, and where possible the manufacturer has pre-set the adjustments on the carburetor.

The engines we use are of two basic types—those that have a ring, and those that don't. If your engine has a ring, it should be broken-in while running at a rich four-cycle setting. This is necessary to give the ring plenty of lubrication from

(Continued on page 112)

'86 Southwest

Eighty jets drilled holes in the skies of the Lone Star state.



by RICH URAVITCH

THE 1986 Annual Greater Southwest Fan Fly is now behind us but those who attended said it was the best yet. It's supported by an increasing number of enthusiasts, too. This year's event was held over the September 21-22 weekend in the Dallas-Fort worth area and its success can be largely attributed to the cohesive efforts of a group of modelers spearheaded by Dawn Buckley and Ed Couch with the flight line activities ably directed by Ed Perez.

The flying site was a private airport on the grounds of TV evangelist Kenneth Copeland, who just happens to be an old school buddy of Lynn McCauley, who just happens to be as deeply immersed in ducted fan airplanes as one can get. He's the guy who did the F-84F, A-10, and F-104 that you regular "Jet Blast" readers will recall seeing on these pages. His new stealth fighter looks like it will work well.

Butch Sichel's Concord creating shade for the runway; there was a hot Texas sun. Airplane should be ready to fly shortly.

The flying site itself was typical Texas—nearly horizon-to-horizon blacktop. The wind, although initially stiff, was right down the centerline, and as the weekend progressed, the warm air began to "breathe."

Most of the manufacturers producing items for us fan enthusiasts were on hand, or if not, at least their products were being flown by participants. Bob Kress and his lovely wife, Fran, were answering questions about the RK-740 fan unit and they seemed to be enjoying the event. Bob has been consistently improving the 740, the latest units being supplied with a molded-fiberglass duct with an integral cylinder-head cooling chamber. Nick Ziroli watched a number of his designs perform consistently well, among them the Phantom of Terry Best with a home-brew fan that uses a cut-down Viojett rotor running inside a piece of PVC pipe approximately 4 inches in diameter.

Bob Viojett and Tom cook were both on hand with their Sport Sharks and Starfires respectively. Each of these chaps, in addition to frequently flying his own airplane, could always be found helping out other modelers. Although I didn't make an accurate count, the number of these two types of jets present appeared to be about equal.

Byron Originals was represented by Rick Alter along with his son Chris of Sioux City, Iowa. They brought an F-15 Eagle and the new BD-5J with a thrust attenuator installed. Seemed to work well. The Big Eagle was flown repeatedly throughout the meet and never failed to impress the crowd. There were more examples of the Byron F-16 there than any other type. And those who flew seemed to do well.

Kerry Sterner's F-80s were streaking about with a particularly visible red Kan-Ang version, built by Tom Perry, that drew much attention. All of the F-80s present were using the Byrojet fan unit but we understand that a version should be available soon for the Dynamax so builders may take their choice.

A gathering of this type never fails to produce

Fan-Fly

Above: SAAB AJ-37 Viggen Thunderbolt was scratch-built by Bob Thacker. Very realistic. Left: Dave Thomson's Canadair CL-41 Tooter in Snowbird livery. Possible future kit.

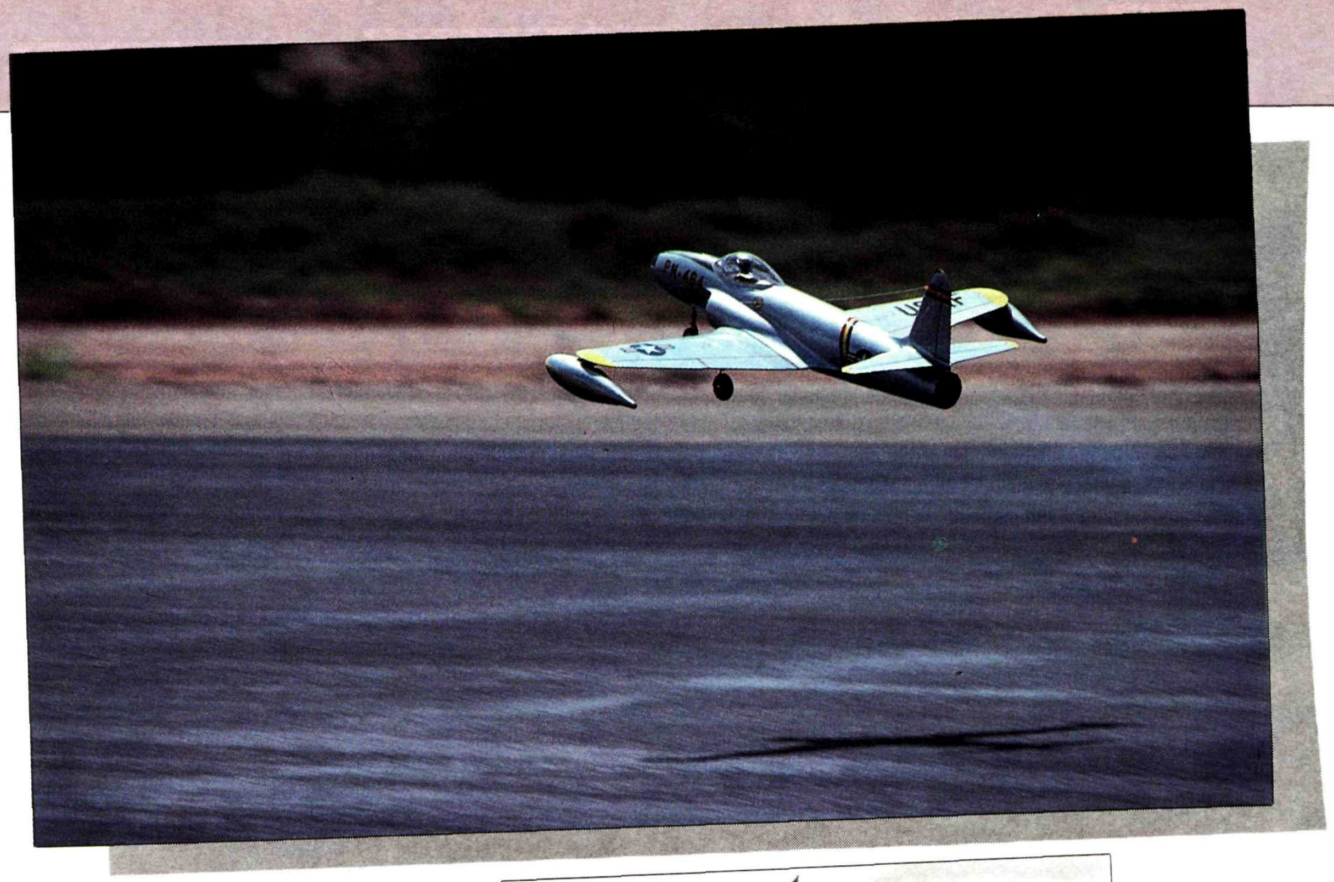
fresh concepts and innovations. When this event premiered four years ago on a very hot summer weekend in Lockhart, Texas, I think nearly everyone in attendance was surprised at the great turnout. One need only look back on the time since that meet to see how fans have progressed. Some examples? Four new fans—Viojett, Dynamax, RK-740 and production Turbax III. And new kits—Starfire, Sport Shark, F-86s, F-20s, F-15s, F-4s, F-80s, T-33s, KFIRs, A-4s plus others, and more are on the way! All in four years.

Butch Sichel returned with his now nearly complete Concorde. It rates way up there on the BIG scale and undoubtedly qualifies as an ambitious project. It hasn't yet flown but I think Butch's confidence has increased considerably in light of engine/fan development.

Among the nicer looking scale airplanes, there was Col. Bob Thacker's Byro-jetted AJ-37 Viggen, a "one-off" produced by carving the fuselage from foam, covering it with glass cloth and melting away the foam leaving the glass skin. The realistic and lightweight finish was of Coverite's aluminum micafilm.

Dave Thomson brought a pair of scratch-built

(Continued on page 68)

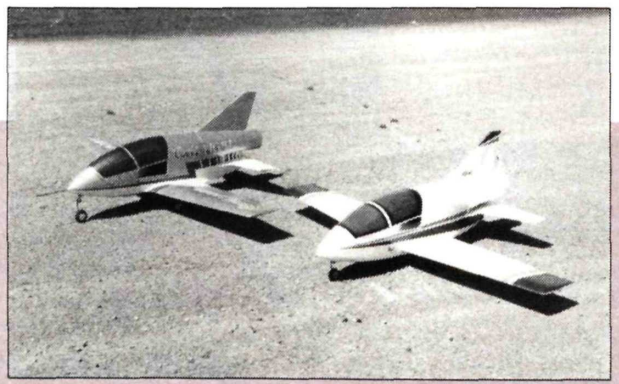


(Continued from page 65)

Canadair CL-41 Tutors designed for the Byrojet. The one that was flown appeared very stable and certainly had one of the more unique sounds of the machines on hand. The Tutor features a fiberglass fuse and foam wing. Dave indicated that he had been discussing kitting arrangements with a number of manufacturers.

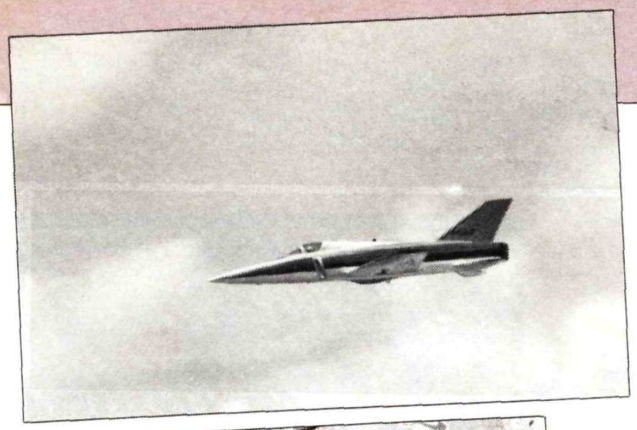
The boys from Austin, the guys who really started this thing four years ago, were on hand with some new things as usual. Topping the list and qualifying way up there in my book of simple, good-flying jets were the BD-40 and BD-5J of Russ Eppright and Tom Sewel. The BD-40 was designed and built by Tom Sewell and uses a KAOS 40 wing with a built-up, balsa-and-ply fuselage. The design worked so well that the Austin bunch got together, made a thinner and faster wing with flaps, carved a plug and started popping out glass fuses. This produced the Coor's Silver Bullet Dynamax-powered version. Russ, who now owns the original Turbax I/O.S. 46-powered BD-40, gave me a chance to fly it and I can report that it is a very manueverable yet

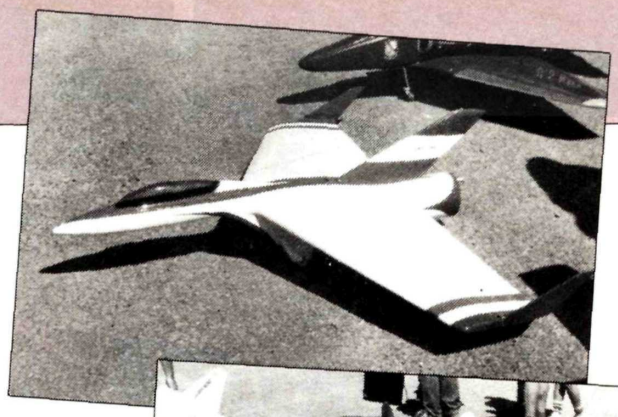
Above: Sterner Engineering's F-80s were consistent smooth flyers, using Rossi-powered Byrojets. Left: Paul Applebaum and Terry Best accept "Jet Blast's" Technical Achievement Award.

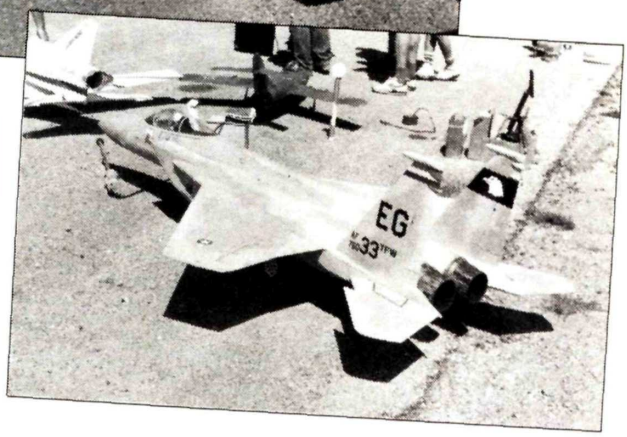


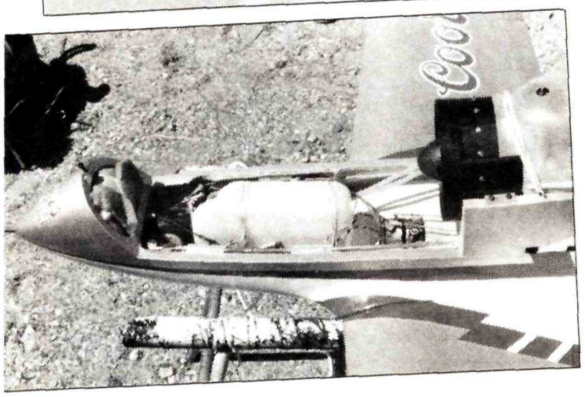
BD-40, foreground, and Tom Sewell's BD-5J. BD-40 is all wood with Turbax I.

Chris and Rick Alter of the Byron team fire up the new BD-5J. Note clam-shell thrust attenuators.









Clockwise from top left: Bob Violett's often-flown swept-fin Sport Shark was very fast; unique Hornet from Bauer kit built by Jerry Kirwan; Byron Originals F-15 Eagle was an impressive flyer; inner workings of Tom Sewell's BD-5J.

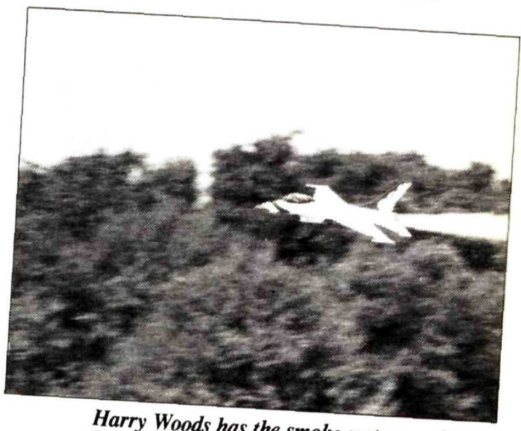
docile machine. I logged one flight and four landings—couldn't keep this neat little airplane on the ground!

Bobby Zieger and Hugh Jones brought their nearly identical rocket ships (Sport Sharks) and got consistent, rapid performance. Lynn McCauley's Dynamaxed F-104 in NASA markings proved conclusively that it could fly; unfortunately, shortly after takeoff, it rolled over and crashed. The postmortem indicated that the L.E. slat linkage on one side failed causing assymetrical lift which was more than the ailerons could counter. Lynn has another under way, but it will have to wait until his stealth fighter is finished and flown, which should be accomplished by the time you read this.

If you think that reporting on this meet's activity is rough because of all the terrific things on hand, you're right! What was tougher, though, was selecting a recipient for the MAN "Jet Blast" Publisher's trophy for technical achievement. It was an extremely difficult choice. After much consulting with lots of people, it was finally presented to Terry Best and Paul Applebaum for their Ziroli Phantoms and Viggens powered by the home-brew fan unit developed by Terry.

It was nice to see AMA officers Johnnie Clements and Buddy Irwin present. They appeared to be enjoying themselves, observing and talking at length with many of the participants.

Final Tally at the end of the weekend indicated more than 80 ducted-fan engines were on hand. By anyone's yardstick, that's a great turnout and indicative of the growth of this small segment of the R/C hobby. The important thing is that the participants were, for the most part, sport flyers who decided on jets. They weren't "engine men" or pylon racers, despite the myth that you've got to be either one of these "types" to successfully fly ducted-fan airplanes.



Harry Woods has the smoke system on his Byron F-16 really perfected now.

As far as I know, present plans call for an even bigger Fifth Annual Southwest Fan Fly for 1987. Stay tuned for details. And plan to attend! ■

Sterner Engineering F-80 Shooting Stars. One was built by Kerry Sterner, the other by Tom Perry; a popular kit.

Terry Best's Ziroli F-4 Phantom with home-brew fan driven by Marine K&B 7.5. "Jet Blast" Technical Achievement Award.

Helicopter Cha

by CRAIG HATH

WE RELY a lot on minor details to keep our models flying. I've experienced many failures that could've been avoided by proper assembly and maintenance. I once had the misfortune of crashing one of my machines on the initial lift-off just after the repair of a previous crash. The cause turned out to be a tiny screw which decided to vibrate loose. The damage this created was almost identical to the damage I just repaired. If experience is the best teacher, then please allow yourself to learn from it!

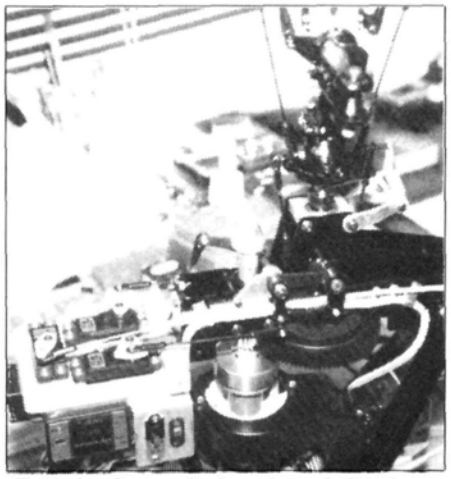
Passing on some valuable lessons to the beginner and intermediate flier is the main thrust of this column. I've witnessed the vast improvement of several fliers due to the help that they've been receiving. You may not be as fortunate.

When I was getting started in helicopter flight, I had to learn by trial and error. Consider yourself lucky if you have good help. If not, I hope that this column will be worthwhile and save you a few dollars, and hours of aggravation.

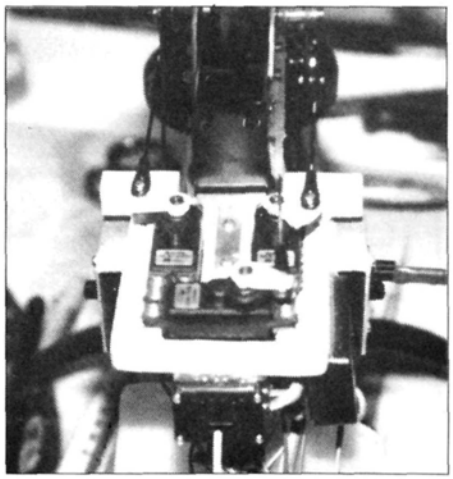
Last month, I left off with the main components of the basic mechanics ready to accept the tail boom and tail rotor assemblies. Usually, you'll have to assemble the tail rotor transmission to some degree. Some machines will require you to put bearings on gear shafts, and place these into a housing. Others will have pulleys and belts. If you're working with a transmission, be sure you get the correct bearings in the right place. Often, there will be one or two ball bearings that have shields built-in to prevent dust and dirt from entering the races. These shielded bearings are intended to be placed anywhere that's exposed to the elements. A non-shielded bearing is one in which the balls are visible through a cage or retainer, and are intended to be used in an oil or grease bath environment. Study the drawings and refer to the instructions to be sure you get the correct bearing placement. Some instruction manuals refer to the use of cyanoacrylate glues to retain the bearings onto the gear shafts. I don't like this procedure, due to the high risk of getting some of the glue into the bearings and ruining them. Loctite* manufactures a product called "Stud and Bearing Mount," which is safer and just as effective. I wouldn't recommend that you use this product on regular threaded fasteners, as it is intended to be permanent. Use the regular Blue Loctite, or other similar products for retaining threaded fasteners that might require occasional removal.

Once the gears are ready to accept the bearings, take the time to trial-fit all of the parts into the transmission housing. This step can save you some grief if you run into problems with gear mesh. "Gear mesh" refers to the smooth operation of the transmission, the teeth of the gears making good, solid contact with each other. Setting the gear mesh is probably the most important aspect about the tail rotor transmission assembly. After all of the parts are fitted into the transmission, rotate the input gear shaft. If there is roughness or grinding during rotation, find the source before proceeding with the final assembly. Don't assume the gear mesh will wear in with use, as the opposite will occur! The gear mesh will wear out. Also, be sure you get the input and output gears in the right place in the housing.

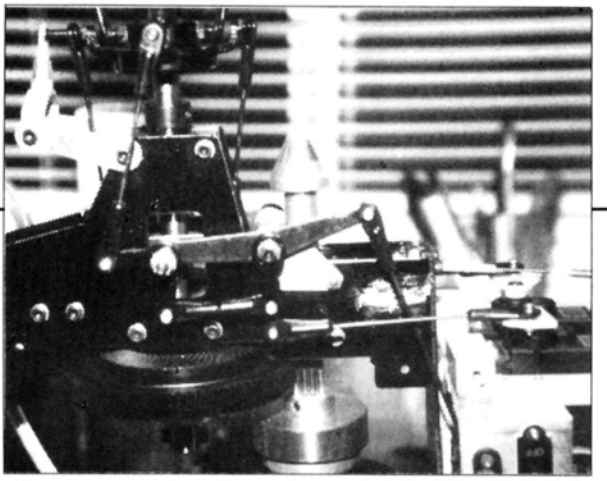
There is nothing in model aviation that will rival helicopter flight. However, it can only be achieved with accurate assembly and adjustment, and careful flying practice. Shown is a Heli Boy from Schluter.



Typical radio installation. Notice ball links at the servo, providing very positive control.

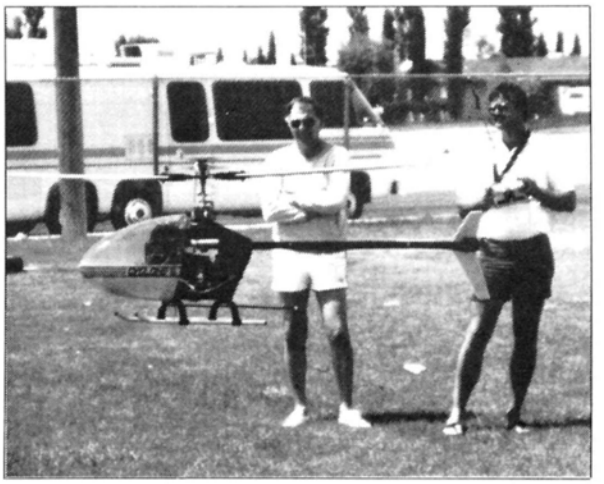


Servo placements have to be planned for best location to place outputs appropriately.

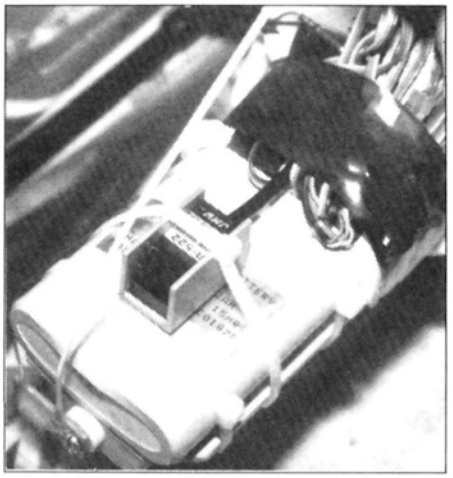


Be sure to get bellcranks set at correct angles. Also check that swashplate is level when servos are neutral.

Notice neat layout of gyro control box and switches. Canopy may be easily removed.



Who is really flying this helicopter? A helicopter will let you get away with a lot, but this is too much.



Typical mounting of battery pack, antenna, and receiver. Foam protects against vibration.

Now that the transmission operates perfectly, disassemble the unit and remove the bearings to apply the stud and bearing mount. Before the liquid stud and bearing mount has a chance to cure, reassemble the gears in the housing and re-check the gear mesh.

Finish the assembly of the housing per the instructions, and be sure to add grease to the trans-mission. If there is no reference to the type of grease in the manual, try some white lithium brake lube, available at most auto parts stores. This grease won't attack plastic, and holds up under high temperatures.

With the tail rotor transmission complete, prepare the tail rotor drive shaft and tail boom. Most kits provide good instructions for getting the tail rotor drive shaft cut and bent (if necessary) to the proper length. Follow the instructions. Most tail booms receive one or more drive shaft guides inside the boom to prevent the shaft from "whipping." Be sure that you grease the guide well, or allow for oiling it by drilling a small hole just ahead of or behind the guide. If the guide is allowed to run dry, there's a chance the wire shaft

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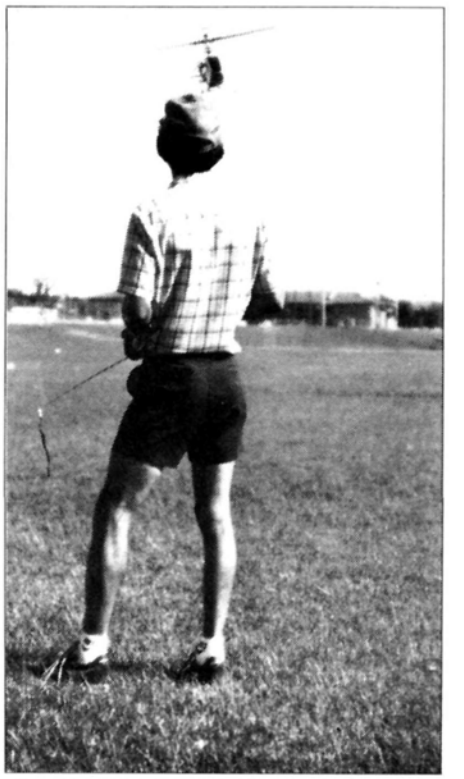
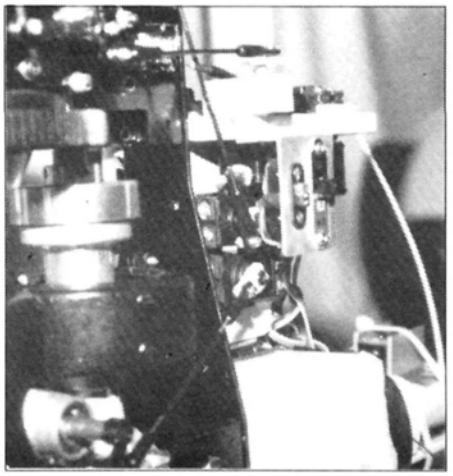
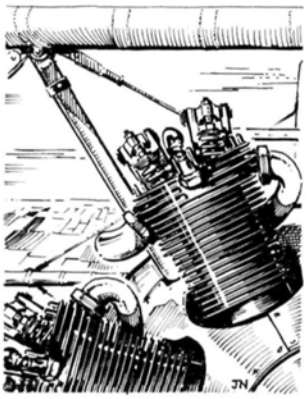


Tom Hart chatting with his Cobra's front end. Nose-in flight is easy for experts; takes practice.



Two lower servos operate throttle and collective pitch. Avoid any metal-to-metal contact.

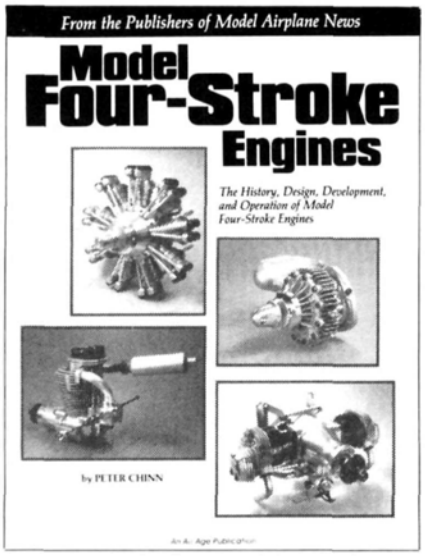


Four-Cycle Forum

by ELOY MAREZ

THE TWIN CESSNA in the photograph has appeared in these pages before, but how could I not share this dramatic photo with you. Before you start thinking, "Well, he's strayed off the subject again," let me tell you that it's a four-stroker!

This model was first seen here in the March 1986 issue. It belonged—yes, I understand it is now gone to that great big hangar in the sky—to Helmut Dressendorfer of West Germany. A BIG one, it spanned 14.75 feet, length 5.58 feet, and the all-up weight was 75 pounds. Power was two Kavan FK-50 twins, which if you don't recall are rated at just over 4 horsepower, with a displacement of 50cc, or 3.0 cubic inches. Helmut is a terrific pilot, whom I have seen flying many times, but a low pass with a 75-pound Cessna 310 is something to be admired. I don't know who took the photograph, which came to me courtesy of Franz Kavan, also of West Germany, but those of us who consistently use up many rolls of film in an effort for that one great in-flight shot can really appreciate it.



The definitive book on model four-stroke engines is by Peter Chinn, published by Air Age.

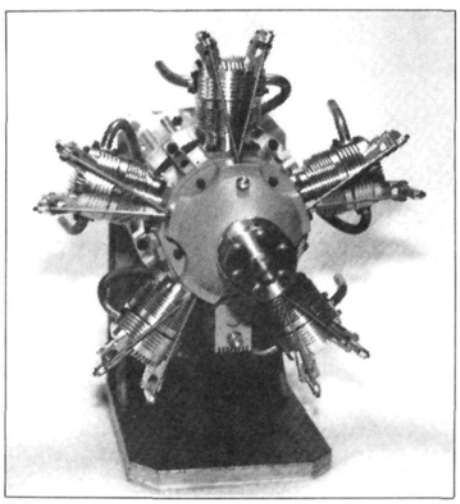
This is a "big un"! By Helmut Dressendorfer of West Germany, the Cessna twin spans 14.75 feet and weighs 75 pounds; power by two Kavan FK-50 twins.

Nuremburg

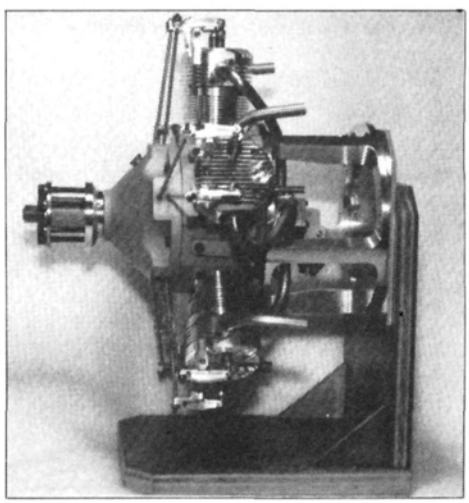
West Germany is in the news as I write this; in just a few days I'll be leaving California's sun and warmth for Nuremburg, site of the largest model show in the world. It takes place during the week of February 5 to 11, and while it is actually billed as the Nuremburg Toy and Model Fair, the model portion in itself still qualifies as the largest anywhere. As soon after as schedules, deadlines, etc., permit, I'll share with you whatever exciting four-cycle news I run into on the other side of the Atlantic!

Model Four-Stroke Engines

And the other side of the Atlantic is still in the forefront. I want to tell you about Peter Chinn's great book, *Model Four-*



Fred Kunze designed and built this gorgeous 5-cylinder radial engine; spark ignition.



The Kunze Five is based on a Forrest Edwards' design with numerous modifications.

Stroke Engines.

If you're a serious four-strokenik, here is some serious advice for you! If you haven't already done so, do yourself a big favor and immediately order a copy of this book for yourself. The title page describes this 130-page, 8.5x10-inch, soft-cover manual—and truly it is a manual—as "A complete guide to the history, design, development and operation of model four-stroke-cycle engines, including an appendix with specifications, performance data, and installation drawings." This is an accurate description if I ever read one, with emphasis on the word "complete."

After the introduction in which we learn about the correct way to refer to our favorite model powerplants, i.e., four-cycle or four-stroke; comparison with the other types of engines, noise, cost, power, etc., the book breaks down into 12 chapters, entitled: History and Development; The Four-Stroke-Cycle Principle; Types of Four-Stroke Engines; The Cylinder Head; Valves and Valve Gear; Camshaft Drives; Rotary Valves and Sleeve Valves; Other Design Considerations; Carburetors; Rotary Combustion Engines; Operation; and Care and Maintenance.

If that doesn't cover "Everything you always wanted to know," I don't know what would. This type of book can often be a disappointment, through no fault of the writer or of the publisher because the industry moves so fast that by the time things appear in print, they've been obsoleted by at least a couple of generations. No so Mr. Chinn's work, and I have no idea how it was done, but this one includes such up-to-date material as the Enya Vee-Twin and O.S. Sirius Radial, both 1986 engines.

Included also is a compendium of test data of various four-strokers, including specifications, drawings, performance curves and reference to when a full review article appeared here in *M.A.N.* on the following engines: Hirtenberger HP VT-21, O.S. FS-20, Enya 35-4C & 40-4C, Webra T4-40, O.S. FS-40, Saito FA-40, Kalt FC-1, Saito FA-45, Enya 46-4C, Enya 60-4C, O.S. FS-60, Enya 80-4C, Webra T-4, Enya 90-4C, O.S. FS-90, Saito FA-90T Twin, O.S. FS-120, Technopower 7-Cylinder Radial, Technopower "Big-Bore 5-inch Radial, O.S. Gemini-160 Twin, and the Kavan FK-50 Mk II.

In summary, I'd like to say that I too have some of the other books on this subject that have appeared. Unfortunately, most are heavier on the history than on anything else. And while that does make for interesting reading, this book differs in that it includes useful and current data that will help you to understand your four-cycle engine and to keep it in top operating condition.

Oops!—almost forgot—for the source check out the *Model Airplane News* book ad elsewhere in this issue or you can simply send in your order to *Model Airplane News** at the address listed at the end of this article. The book is $13.95 plus $1.50 postage and handling ($2.50 for foreign orders). Credit card holders can call toll-free 1-800-243-6685 or 203-834-2900 in Connecticut.

Kunze Five

The other engine in the photos really had no name—until I christened it the Kunze Five! It is designed and built by Fred Kunze, of Bellevue, Washington, and in his own words:

"It is based on the Forrest Edwards design, but I elected to keep the front of the case clean and uncluttered so I moved the lube pumps to the rear of the engine.

(Continued on page 79)

Golden Age of

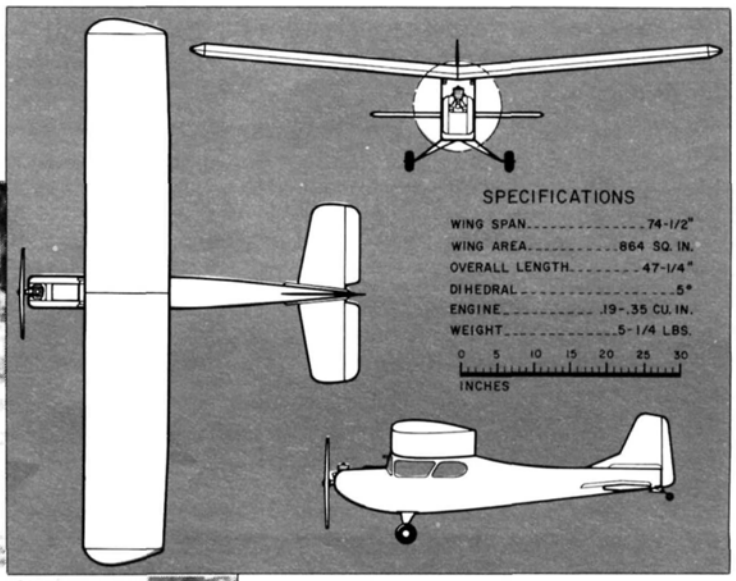
by HAL "PAPPY" deBOLT

AFTER R/C cut its teeth with the infant ability to fly successfully, two significant developments brought it into maturity.

The proportional and reed systems were the foundation which made success possible. The reed system taught us which modes of control were usable, and developed the multi-control aircraft parameters, which went on to make the transition to full-scale control and performance possible. While the reed system is noted for leading us into multi-control, the aircraft themselves represented another important advancement.

I've already discussed the adventures of the pioneers who brought reeds to us. Hindsight causes one to wonder what historical changes might have developed had the two inspired modelers lived beyond the initial stages. Fortunately for model aviation there were others to carry on. At this point the "Golden Age" research ability flounders for lack of pertinent information. We really need some input from anyone who was close to these operations. Your help is greatly appreciated!

Dean Kenney displays one of the early LARKS designs, which strongly influenced the Smog Hog, and in turn all of R/C airframe design.

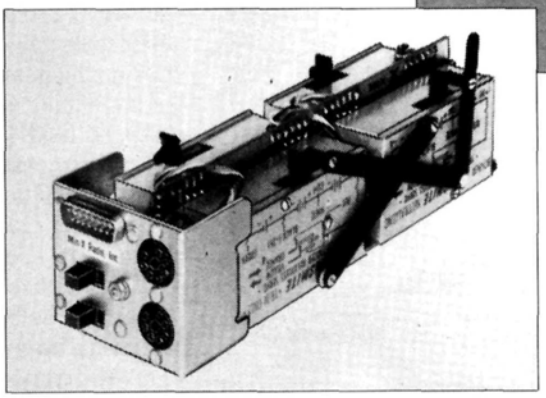


Howard Bonner and one of his single-channel R/C airplanes that pointed the way to the amazing Smog Hog. Soon after, Bonner became well-known for his equipment.

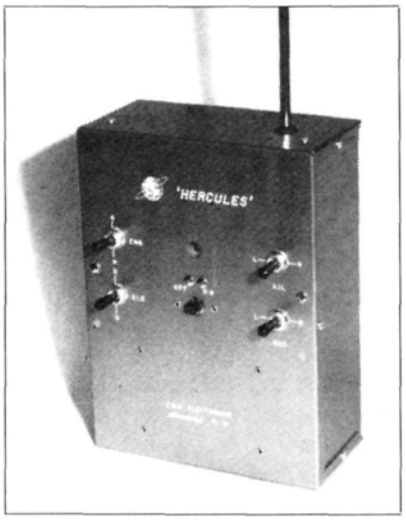
The manufacturers which came to dominate the early R/C scene were Kraft, Orbit, C-G, and Citizen-Ship. We know that Kraft, Dunham, Hoover, and MacNabb also got started in the single-channel days, but it was their reed offerings which launched them into major manufacturers.

The reed system's single greatest advantage was the hand-held transmitter, a

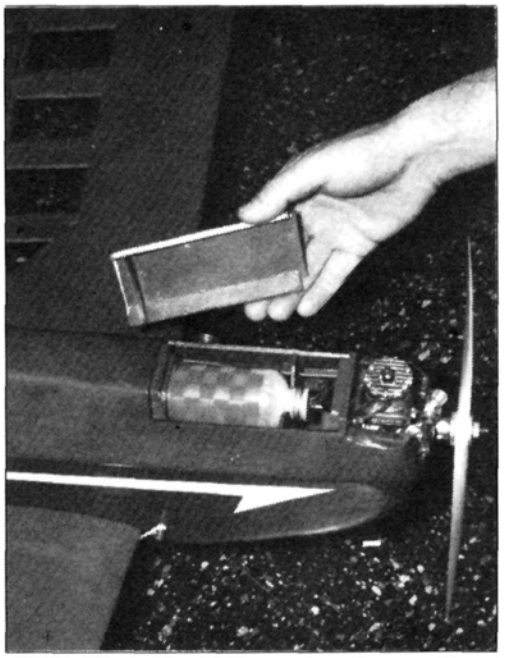
Bonner was noted for his fine workmanship and his 1956 winning Smog Hog was no exception.



Min-X "brick" with mechanics that provided a separate trim function for 10-channel reed operation.



F&M Electronics of Albuquerque, New Mexico, offered the CG brand 8-channel hand-held reed transmitter.



The first "klunk" tanks were marketed by Veco. Note the flapper exhaust valve on this .35 engine.

much more convenient transmitter than the cumbersome, ground-based units with their separate stick boxes. The hand-held transmitters required some drastic changes in hardware. The 9-foot 1/4-wave antennas were replaced by today's neat 1/8-wave telescoping styles. Since the smaller wave antennas required "loading" to be efficient, the 27MHz Orbit antenna's loading coil was in the middle section of the collapsible rod. At long last, the transmitter didn't have to be set up and taken down at each flying session!

It was the Dunham-Orbit initial reed transmitter which established the style for all that followed. With the change to hand-held, the single-stick which required complex mechanics became obsolete; a simpler design seemed in order. The resulting arrangement was so simple it was almost like reverting to single control. The reed system used a double-throw toggle switch for each control. One switch for each control function which alternates between the two channels (as needed by the servo requirement). At this time, reed system capabilities were also rapidly advancing and with the transmitter change came the 8-channel systems, described as "REAM" for rudder, elevator, aileron, and motor.

Like today, the transmitter cases were designed to be held in both hands. Holding the case in this manner, there had to be the ability to operate the switches. The best possible way was with the thumbs, so the switches were arranged accordingly; two switches on a side close to the right and left borders of the case.

On the right, the two toggles moved left and right controlling the rudder and aileron. The left-side toggles moved up and down controlling the elevator and engine. Later on, 10- and 12-channel systems were developed, adding more toggles, resulting in an appearance similar to a jet control panel!

Imagine flying with these transmitters? Your thumbs would be jumping from one toggle to another! With the advent of 10- and 12-channel systems came still another way to have control trim. An ingenious servo mounting was invented which coupled the two servos together. As with the elevator, the control servo was coupled mechanically to a "trim servo." The trim servo could alter the location of the elevator servo, fore and aft, effectively changing the pushrod length and giving the trim desired.

With so many toggles involved, operating a reed transmitter was like playing a musical instrument, a coronet or saxaphone perhaps. It was no longer very simple to fly R/C. Becoming an accomplished pilot required constant practice, if only to become accustomed to the transmitter. The champion pilots of that day were true virtuosos of the box.

By plugging the servo into a different cable it was possible to change the

(Continued on page 82)

Small Steps

by RANDY RANDOLPH

RESPONSE to this column has been good and immediate! Our thanks to all of you who have written and offered suggestions and ideas, Joe and I are very grateful. This is a labor of love for us and we hope it will show in these pages.

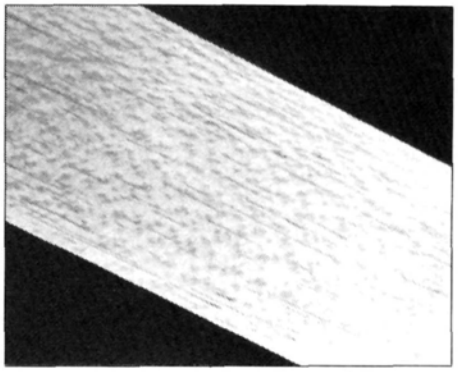
Before going to reader input, a few words on a subject started last time, the subject of lightness and how to add it, rather than weight, to our smaller airplanes. Briefly touched upon were the different types of glue and some of the materials that are heavy but useful in certain applications. The primary theme in this discussion is the necessity to build small airplanes that are lighter per square inch than their bigger brothers.

The idea is a structure that will withstand the flight loads imposed on the airplane by normal operation, with a little extra to handle unexpected panic maneuvers. If this criteria is met, it will result in a light airplane that will fly beautifully and usually survive all but the most destructive crashes. Light airplanes have less kinetic energy to dissipate within their structure when contact is made with immovable objects.

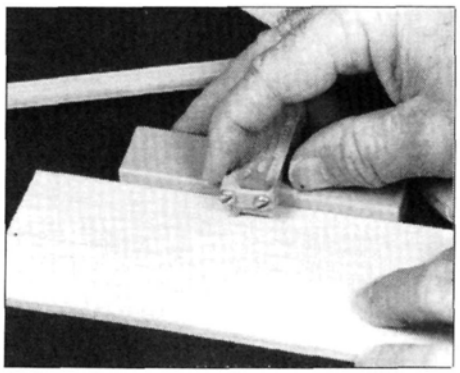
Without question, balsa is the best material for the construction of small airplanes. But there are all grades and weights of balsa, and only those weights that fall in the light to medium range (4 to 8 pounds per cubic foot) should be considered. An excellent source of light wood is Lone Star Models*. When they state 4- to 6-pound wood, that's what they ship!

The "grain" structure is also an important consideration. Long, even grain lines that extend the full length of the sheet, or strip, are good for spars and longerons (A-grain). Sheets in which the grain appears to be mottled with a sort of pearlessence are ideal for ribs and sheeting on flat surfaces (C-grain). Most balsa falls between these two types so the idea is to test the sheet for across-the-width flexibility. The more flexible it is, the closer it is to A-grain; the stiffer it is, the closer to C-grain.

Spars and unsupported longerons should use the heavier weights of balsa



C-grain balsa has a distinctively mottled appearance. Very stiff, great for fuse, ribs, bulkheads.



Balsa strippers are a real money saver. This one by Master Airscrew is adjustable.

(7- to 8-pound), while members that are not required to carry flight or landing loads can use 4- to 6-pound wood. Select the proper wood for the job and a strong, light structure will result. Don't forget to sand the open framework before covering. There is something about a structure, smoothly sanded on all sides, that seems to be stronger.

Every modeler should have a balsa stripper. There is no way to match longerons, spars, or leading edges unless they are stripped from the same sheet of wood. Even then be cautious, for there are harder and softer areas within a single sheet of 3-inch-wide material.

Mailbox

A letter from Ralph Pearson* offers an answer to the throttle problem for ½A engines:

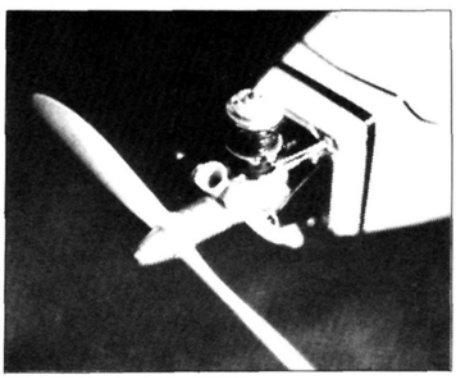
"About 5 to 6 years ago, on a hunch it might work, I mated an old Cox* Medallion R/C crankcase (this one has a rotating needle valve body) and a T.D. .049 piston and cylinder, using an Ace* throttle sleeve. I soldered a new brass arm on the needle valve body and discarded the retaining clip and needle spring. A piece of fuel tubing acts as a retainer, seal and 'position hold' for the needle valve.

"Since the needle valve body needs to move very little (about 10° or less) to be effective, I really had a problem with linkage. To keep things simple, I ran two .030 cables back to the servo arm; one to the outside hole (throttle sleeve), the other about halfway out (needle valve body). This will vary with make of servo and type of arm. I was lucky, I got the right action the first time. I've been in R/C for over 20 years, so don't take it lightly when I claim there is no better throttle at our field, regardless of engine size! I have a definite change in rpm with every click of the throttle stick.

"Over the past 5 years at least a dozen others have flown the Eventrix and regardless of what they do, it has never quit on anyone! Eventrix taxies out (on a grass field), takes off in about 15 to 20 feet, does touch-and-go's or anything else, lands, and taxies back just like the big boys—this with three gaskets under the head and 10% club fuel. Also it starts easier than a straight T.D. and the needle isn't sensitive at all."

Ralph's Eventrix is a clean looking bird with a 36-inch span 240-square-inch wing. Flying weight is 21 ounces.

I discussed Ralph's idea with my partner and engine expert, Joe Wagner, and here is his answer: *(Continued on page 104)*



Ralph Pearsons' throttle for his Eventrix. See text for details.

FOUR-CYCLE

(Continued from page 75)

Also, I made provision for driving a spark-ignition distributor, the shaft of which is visible behind cylinder number 5."

What can one say—except maybe, "Gee, why didn't I study metal machining when I had the chance?"

Valve Grinding

This subject has been mentioned here before! As I've also said before, I hesitate to get into the subject because it is one of those things which, if incorrectly done, can do more harm than good. And there is no way to back up either. Anyway, we've received a letter from William Miller, of Lakeland, Florida, who details a method that works for him. Bill writes:

"Read your article on four-cycle engines in the September issue of *Model Airplane News*; hope the following information will help some four-cycle owners with their valve problems.

"Following disassembly of cylinder heads and valves, clean all deposits from cylinder heads and valves, keeping in mind what valve goes where in cylinder heads. Carefully clamp cylinder head inverted in a vise. Having applied valve seating compound to a valve, install valve in proper position in inverted cylinder head.

"Using tight-fitting rubber tubing on extended valve stem and holding tubing between extended fingers of both hands, rotate tubing at same time applying downward pressure to grind in valve seat. Every so often, lift valve off the valve seat, then continue rotating valve with slight downward pressure.

"Having obtained a good 360° valve seat on both valves, clean all seating compound from cylinder head and valves. Install burned-out glowplug with gasket in cylinder head. Assemble valves in cylinder head in their proper positions and re-clamp inverted cylinder head carefully in vise. Pour lacquer thinner into cylinder head, being careful not to spill any. Check with pen flashlight at valve seats through valve ports in cylinder head for any seepage. If valve seats are dry, you have done your valve seating operation properly. The end results will be good compression, more power and a smoother running four-cycle engine. Hoping I have been of help...."

Let's review! Upsidedown cylinder head. Compound covered valve installed. Rubber tubing pressed over valve stem on bottom. Rubber tubing twirled between hands, while pulling downward to exert pressure on valve. Sounds like it should do the job. The only thing Bill forgot to mention is his choice of compounds. Be careful there! The most common you'll run into in auto supply stores is Clover brand lapping compounds, which come in grades from 50, which must look and feel somewhat like popcorn, down to 1,200, which is termed as "micro-fine" and, like all the finer grades, is mostly useful for polishing. The common two-sided can of Clover contains two grades, 120 and 280, which are all right if a lot of material has to be taken off and for initial evening. However, for valves as small as we are working with, I'd recommend even finer grades such as 400 and 600 in succession. The extra few minutes spent with each kind will pay off later. I do want to emphasize Bill's instructions about removing all of the compound from both surfaces. Remember that any of it left inside the engine will keep on doing its job, that of removing metal from the inside of your engine.

If you prefer your valve grinding to be done with a little more class, you might consider Luster-Lap Diamond Compounds, which actually contain diamond particles in an oil base of some kind. A

(Continued on page 82)

Radio-Contro

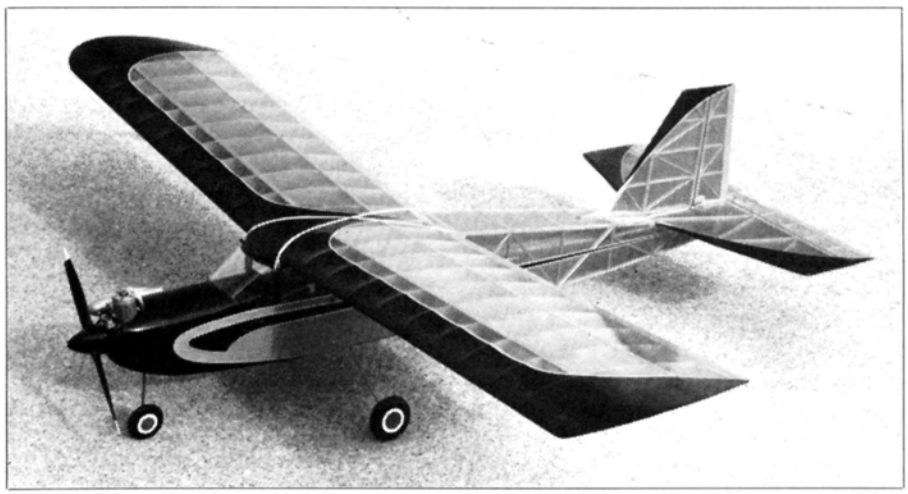
by ART SCHROEDER

I'VE JUST returned from the 1987 Westchester Radio Aeromodelers' (WRAM) Show. It was held for the first time (and I gather the only time) at Yonkers Raceway, a trotting raceway in Westchester County, New York. The shift from WRAM's traditional site at Westchester County Center was necessitated by renovations going on at that facility.

I'm not reporting on that total show now; only bringing some impressions of our hobby/sport as I see it in early 1987. First, nearly all manufacturers are reporting healthy gains in sales and production. It appears that R/C model airplanes continue to be a growth industry.

Along with growth has come outstanding quality in kits, engines, accessories, and radios. Booth after booth, virtually everything I saw was top-notch.

Of course, there were new kit releases, several new engines, lots of radio releases and an incredible array of accessories. There was not, however, the kind of stories that come from shows in years past which included: digital propro radios, the emergence of helicopters, MonoKote, ARFs, cyanoacrylate glues; whatever spectacular advances our hobby/sport has gone through. This year did not seem to be the year of some "thing."



Name of the year! Sig's new Kadet Senorita, a smaller version of their outstanding Senior, for .15 to .35 two- and four-stroke engines.

Rather, it was the year of quality and value for the dollar to be spent. I see our hobby industry as having reached a solid level of maturity. It is very difficult to buy any product that does not do what it purports to do. That has not always been so—*it is in 1987!*

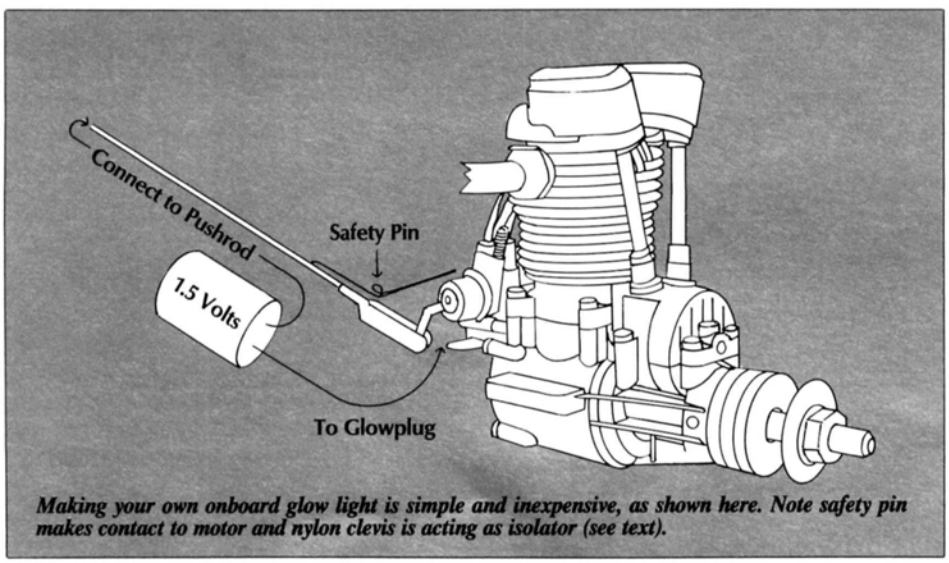
And, if anyone needed proof of R/C growth, it came at the entrance door. At noontime Saturday, according to Yonkers Fire officials, 10,000 people were in the raceway clubhouse and that was the limit. Those waiting—and the line was considerable—had to enter on a one-to-one basis. As one person departed, one entered. I have no idea how many actually attended, but I can say the WRAM show has certainly approached—if not exceeded—Toledo levels. It is 19 years old and still growing! I wonder what it will be 19 years from now or, for that matter, what the R/C hobby will be like in that period—should be something to see!

Cyanoacrylates

That cyanoacrylate glues have markedly changed model building is now without question. Given the variety of cyanoacrylates available along with accelerators, we can put together the most complex airframes in record time. Indeed, most of yesteryear's adhesives—epoxies, white glue, and cellulose glue—can be relegated to specialized functions. The glue of general choice should be cyanoacrylate; it does most everything, in its various forms, to an efficient level. And it's lighter, quicker, and, in most cases, best for model building.

But, as with all items we use in modeling, you must be careful. I tend to be careful and I still run into problems.

It's difficult to understand how little cyanoacrylate is needed (particularly when the thin variety is used). Where good joints exist, only a drop is needed.



Making your own onboard glow light is simple and inexpensive, as shown here. Note safety pin makes contact to motor and nylon clevis is acting as isolator (see text).

The tendency is to flow-in glue; believe me, it is not needed. One drop does the job! Where joints need to be filled, use the thicker varieties and an accelerator. Not much is needed in these cases.

I know all this, and yet I continue to glue my fingers to airframes. I'm a slow learner! The answer comes with PIC* (Penn International Chemicals) Skin Shield.

If you haven't used Skin Shield, you should. It's a creamy substance that is rubbed into one's hands prior to building and eliminates bonding your hands or fingers to work being done. At the same time, Skin Shield doesn't cause any bonding problems with the materials you

(Continued on page 115)

Vought Corsair flown by the Confederate Air Force—not R/C but so beautiful.

FOUR-CYCLE

(Continued from page 79)

plastic syringe filled with five grams of grade 325 compound is priced at around $35. To save you finding your calculator, that works out to approximately $200 per ounce. Clover Brand sounds better all the time.

Assuming I survive the cold in Nuremburg, I'll see you here next month!

Eloy Marez, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

GOLDEN AGE

(Continued from page 77)

controls among the switches from what the manufacturer recommended. From this evolved our control arrangement description. Mode one was standard, the elevator and engine on the left side, rudder and aileron on the right. This was a convenient arrangement which allowed the use of lateral and pitch controls as desired. When a combination was needed, you didn't have to move your thumbs from the basic toggles. Remember, the reeds were not simultaneous. You applied one and had to release before applying the other. I should qualify this by stating that in the very late stages, Bramco did develop simultaneous ability. Today's popular Mode two was created by the advent of proportional and was influenced by the reed single-stick arrangement.

The proportional system keeps creeping into our discussion. Today, it's a fact of life. It was desperately searched for in the early days with the many pulse systems and the TTPW topping them all. The reed systems were not the proportional answer either. However, some of the champion pilots learned how to use a form of it. You moved a toggle switch to activate a servo. Visualize, if you will, flipping these very rapidly, so that in effect the servo responds like a pulse actuator. The full-throw deflection normally supplied by reeds doesn't provide smooth flight all of the time. The reed box virtuosos could pulse these toggles and get a proportional effect resulting in smooth flight. A popular pastime at a "reed day" Nats was listening to the Navy monitors at each R/C site.

When one of the R/C virtuosos was flying, it sounded like the *Flight of the Bumble Bee* on a xylophone! You might wonder how lesser pilots flew. Unlike today, you didn't constantly fly the model. You could change directions with only a minor touch of the controls. In effect, the model flew itself more than you flew it.

Again we can see R/C development being influenced by the hordes of new modelers. With such an influx, tradition could've easily been set aside as the major market learned from scratch, using whatever was offered. However, there were many modelers who had climbed the ladder with single-stick, and this market could not be ignored.

Today's control stick design is based on a mechanical gimbal which can feed the necessary information to two, or even three control channels. These developed progressively from the original stick boxes. For single-stick the gimbal was first applied to a hand-held transmitter. It was convenient to cradle the transmitter box on the left forearm. The engine and trim control switches on the right side of the box could be operated with the left fingers. For single-stick this arrangement still prevails. With a Mode two transmitter have you ever desperately wanted to change trims but were afraid to take your thumb off the control stick to do it? With a single-stick you constantly fly with your right fingers (not thumb) while dialing in any needed trim or throttle with the left fingers. Control action and trim functions are separated. Also, the notion that the fingers provide a more subtle control input is exemplified today by the use of transmitter trays for the two-stick styles.

There's more to the reed story, but at this point I'll break in and describe an attractive R/C model design which would fit neatly into any modeler's stable.

Today, many believe that a Telemaster makes an excellent trainer. If you like the simplicity and flight of a TM, here's a grandaddy to match it, with even greater aerobatic capabilities.

The stage is California in the very early days of the reeds. Several prominent west-coasters such as Kenney, Deans, and Bonner were systematically developing R/C designs of a similar nature, as might be expected by their close association. They were all members of the Larks (Los Angeles Radio Control Society), one of the largest and most progressive R/C clubs of the day. The beginning was with single-channel and lead to the transition to reeds. The shared experience was a great help. Alex Schneider's influence must have crept in also, as the model sizes were larger than the norm of the time. This design's greatest asset was that it was developed in stages from rudder-only, to simple multi-reeds, and on to REAM reeds. As the progression went on, both good and unwanted features were observed. The desirable features were passed on to the next phase. The basic "cabin style" continued, with only minor changes in airfoil and wing location, plus tail shapes and such. Whoever concocted the final name for it would surely have found a lucrative position on Madison Avenue.

The "Smog Hog." What visions does that bring to mind? How about a trusty, old craft that's been through the war on a dusty dirt field and reflects its service? It's a tried-and-true veteran for sure!

Seldom does one strike it rich the first time out. Most machines evolve into the sublime as with Jaguar, Rolls, or Ferrari.

(Continued on page 88)

GOLDEN AGE

(Continued from page 82)

Evolution brought the Smog Hog to an exceptional R/C model with a 75-inch wingspan. While the Hog's appearance was just run-of-the-mill, as far as cabin designs go, buried within the design were several secrets which are now a standard for success.

First, the wing was lowered closer to the center of gravity and thrust line. This reduced the pendulum effect and enhanced its controllability. I demonstrated the attributes of a symmetrical airfoil for R/C with the "Over and Under." The S.H. appreciated this by using a NACA 2415 airfoil. The stab gained some efficiency through the use of a simple diamond airfoil. Takeoff and landing performance also improved. The Hog used the popular "knock off" style gear, designed and located to insure good ground handling. A major step forward from previous gears which were intended mainly to protect the model.

Another innovation was the use of better styled fuel tanks, known as "clunk tanks" because of the sound the fuel line weight made. It was nothing more than a round plastic glue bottle, with the appropriate fittings added to the cap. This idea sent many modelers off searching the drug stores for just the right size bottle to fit their needs. The tank wasn't built-in, rather it was secured with rubber bands into a cavity behind the engine; how convenient!

Another major secret was the Hog's power-to-weight ratio and light wing loading. What would a modern 6½-foot-span model weigh? How much more would be added if the radio was about 2 pounds? With diligent attention to structural detail this big Hog's airframe was kept under 2½ pounds! Even so, the structural design was not unlike what's used today.

The light weight provided performance with the popular .35 engines of the time; power-wise about the equivalent of a modern .25. The light wing loading and ample power allowed easy maneuvering and excellent stability, so vital to "bang-bang" style control action!

The Smog Hog reached its apex with a '57 Nats win flown by Bob Dunham. Bob showed up with the first aileron-equipped Hog and proceeded to show the judges how rolls and Cuban Eights should really be done. At this Nats I first met Bob and began a life-long friendship. I was campaigning my custom bipe and the meet progressed to my last flight with most onlookers feeling that Bob had a comfortable lead.

My assistant was Dick Branstner, and as we went to the flight line a Navy judge declared to Dick that he just loved bipes! As I began my taxi maneuver, Dick mentioned the comment to me. The adrenaline must've been pumping, for I put the takeoff right down the runway centerline. When I was through, I knew that I had flown the best flight of my life!

As we left the flight line the judge told us he hoped he'd given us enough points to win. That sure raised my spirits. But he had come up just short. Bob got his win by half a point!

M.A.N. published a construction article for the Smog Hog in the February '57 issue, authored by R.E. Bowen. Apparently, Bowen and Howard Bonner had collaborated on the development of this fine model.

If you're inclined toward an OT R/C for your next project this message could be an inspiration. What a delightful flyer and performer the Hog would make with a modern radio and engine!

Hal "Pappy" deBolt, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

CESSNA

(Continued from page 45)

and easy work. Line the ailerons, stab and the appropriate cutouts with the supplied balsa. Make sure you use the grooved balsa leading edge for the ailerons. This groove is necessary to accommodate the aileron torque tubes. Both the plan and instructions mention plastic wing and stabilizer tips, but a thorough search of the kit failed to turn up any. After a little head-scratching, I determined that balsa blocks were supplied for the tips. Attached again with the PIC combo and sanded, they do the job just fine. They're probably stronger than plastic tips anyway.

This is a thoroughly conventional model, but there are a few little touches that make for a better airplane. One refinement is the torque tube system that replaces bellcranks or flexible pushrods for aileron activation. Thin-walled aluminum tubes extend from wing root to tip. They ride in three press-fit plastic bushings each, while servo motion is transmitted through a simple bolt and plastic horn arrangement. The ailerons are carefully glued to the tube with epoxy. Make sure the torque rod horns are immobilized in the neutral position during this operation. Once you build a wing in this way, you'll wonder why it hasn't been like this all along. It's strong and simple, and there's almost no play at all at the aileron, or drag on the servo, truly an improvement over bellcrank or flex-cables that are supplied.

I joined the wing halves with epoxy. Block one tip as the plans indicate, carefully apply epoxy to both halves, and immobilize in place. There is a massive wooden joiner that helps to align and reinforce the joint. Use a fiberglass reinforcement over the seam. Sand the whole mess down and you'll have one of the

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Giant Steps

by DICK PHILLIPS

I'M OFTEN ASKED by folks wanting to get into Giant Scale models what I'd recommend as a trainer. That's not an easy question to answer. A lot depends on what they've previously done in modeling. Those who've been around for a while, and who've built several models could build almost any large model quite well. That's the easy part. But what can be recommended to the newcomers to our hobby? Until recently, there hasn't been that much. Sig's* large J-3 is a good one, but there's a fair amount of technical building there for the novice. Good kit, great building manual, flies well, and makes a super model, but perhaps beyond the capabilities of the rank beginner.

Midwest's* Giant Sweet Stik is also a good one. It's not difficult to build, and it flies just fine. It flies so well in fact that it could be flown by someone learning, but yet has the capability to fly something close to pattern maneuvers with sufficient power.

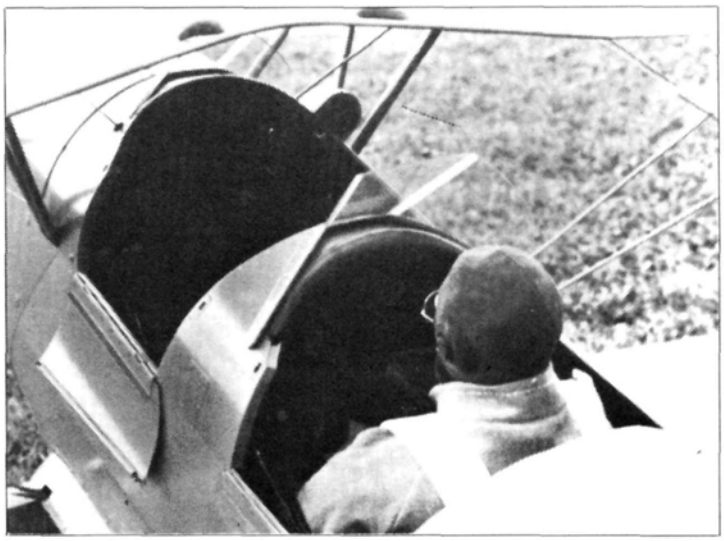
Now there's another kit available which is very similar to the Midwest Stik but with some significant differences. It comes from a firm not particularly noted for airplane kits, but Ace* has been building electronic devices for quite awhile. It's good stuff and it works just as it's supposed to. Now, Ace has a model kit designed specifically for a 1.20 four-cycle engine.

The kit is made up almost completely of Lite-Ply, (poplar plywood). It's one strong airplane, and shouldn't be too difficult for even the inexperienced to build. The shape of the parts helps to explain where they go, and there aren't a million of them to figure out.

It's a very complete kit. The hardware packages (three of them) contain just about every item you could want. No radio, engine, motor mount, or wheels. But just about everything else that's essential is included. Glue and covering are the only other items you'll need to supply.

Plenty of spruce spar material assures a strong wing, and the glass-filled landing gear blank is something I haven't seen before in a kit. Looks like a good idea, and I doubt whether it would bend or break in even the most severe crash.

Bob Nelitz' newest model Bucker Jungmann was predecessor of the Jungmeister. As usual top quality workmanship is evident.

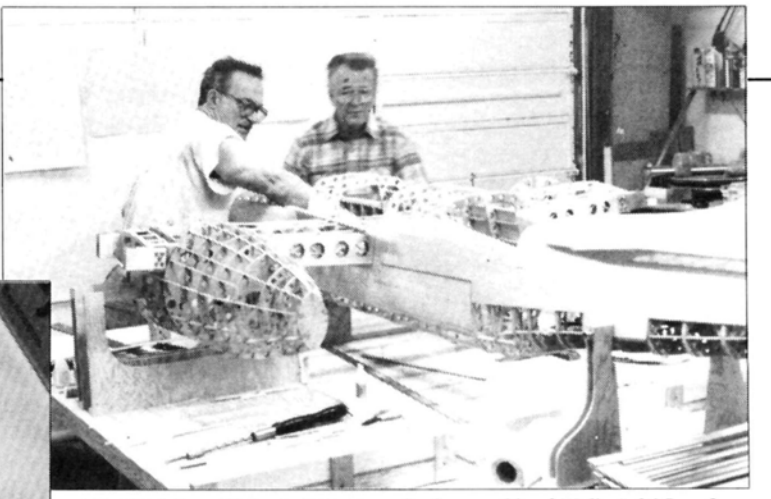


Time spent detailing such museum-quality models pays off in static judging. Bob Nelitz photos.

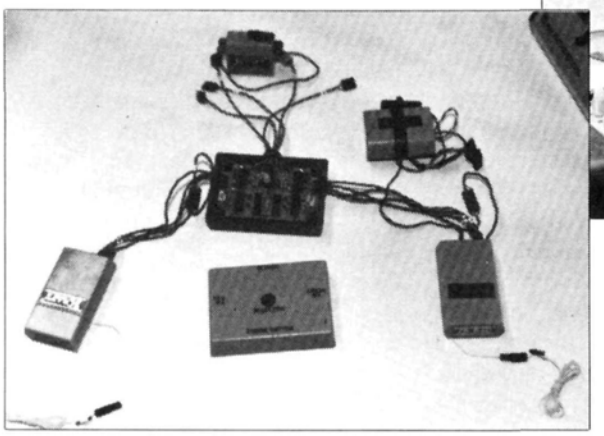
The semi-symmetrical wing provides good flying qualities, and the model should continue to provide good flying, even after the beginner gets to the point of taking off and landing on his own.

Khaw Teik Lim, of Johore, Malaysia recently wrote in with a solution to a problem he's had with losing mufflers from his OS-90FSR engine. Khaw has lost a couple of large mufflers, Part No. 292225000, and was getting a little fed up with having to replace them.

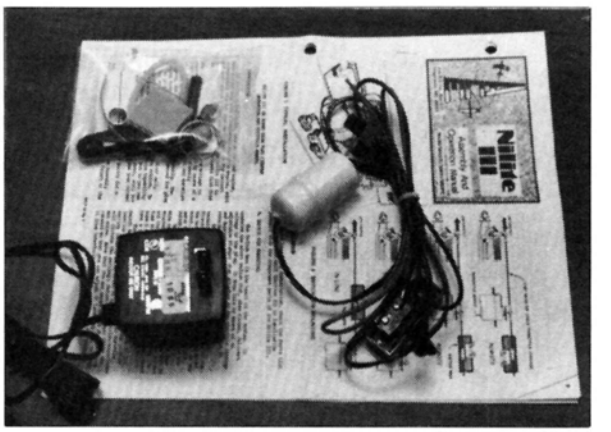
His solution, was to cut two notches in the threaded-sleeve of the muffler which screws onto the manifold. These slots are cut across the center of the hole in the muffler with a fine-tooth hacksaw. Make sure to cut deep enough for the end of the



Mel Nipiuk and Chuck Nicholson check assembly of Mel's A-26 Invader. Construction appears to have been well thought out and executed on this impressive bird. Mel Hibbard photo.



Custom Electronics redundant receiver system. Open box at center is the error switch, heart of the system.



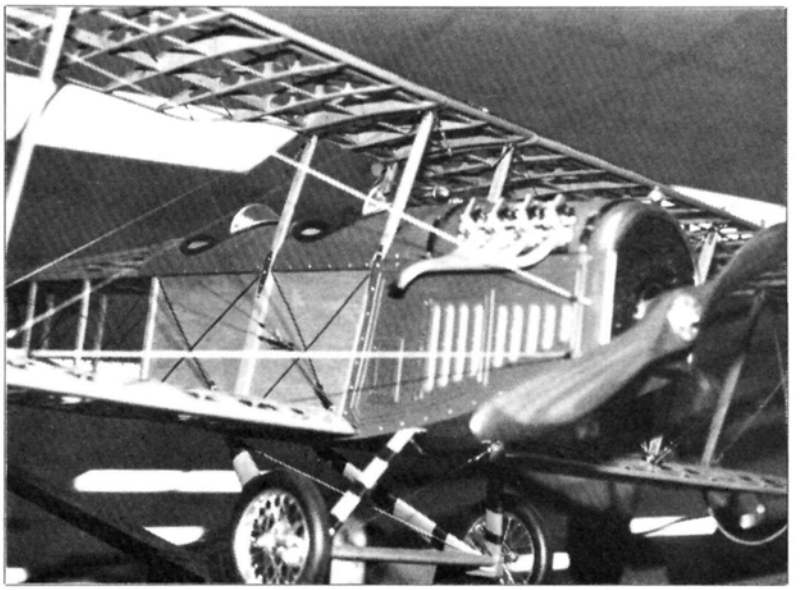
Ace R/C's Nilite III on-board ignition system complete with charger. Nice unit with excellent instructions.

Ace Tachmaster II, a new item from Ace R/C. Three ranges from 5K to 25K.

sleeve to spread slightly, then clamp the muffler over the manifold and secure it in place with a hose clamp of the appropriate size. Khaw says he hasn't lost a muffler since making the change. Sounds like a good idea to me.

Do you use a kill-switch on your large models? If not, you're flying without all the safety that's available and taking unnecessary chances. Why? Because having the ability to shut the engine down in flight can be a significant advantage. I've seen several incidents where having a kill-switch would have saved a model. In one case, the throttle didn't decrease

(Continued on page 108)



New Lou Proctor kit seen at North West Model Expo. Jenny kit has all the quality and realism we have come to expect from Proctor kits.

CESSNA

(Continued from page 88)

strongest, straightest wings ever put on a model airplane. It's almost too nice to cover.

The fuselage is next. Take it out of the box. Attach the wing, stab, and engine. Go fly. Seriously, though, it's just about that easy.

The fuse is simple and basically complete. Epoxy the firewall, wing hold-down plate and landing gear block in place. Although not shown, I recommend bracing the firewall with two lengths of triangle stock. Cyanoacrylate glues also worked on the fuse, but use epoxy for the high stress areas. The firewall and cowl area is a bit tight on this model so careful planning is necessary if you choose to use a four-stroke engine. I received an early kit and mine had no motor mount. The kits now being shipped come with beam mounts. Sig* aluminum motor mount beams were used to carry a beautifully made Webra .40. A J'TEC* in-cowl muffler completed the firewall-forward installation with room to spare and without spoiling the appearance of the cowl. If appearance isn't as important to you, the motor can be side-mounted instead of inverted as shown on the plans.

There's gobs of space available here for any radio made after 1960, the only unusual aspect being the total lack of internal structure to secure it. This was easily fixed with balsa (or hardwood) blocks glued in the appropriate places. Velcro strips were used to hold the receiver and battery in place. The kit supplies some of the pushrod material needed, but I wound up using more familiar products. Flexible pushrods are used to operate the throttle and nose gear, while ¼-inch spruce rods drive the rudder and elevator.

Covering is fun and simple. I used MonoKote for the wing and stab. Trim was applied to the fuselage using Mono-Kote Trim Sheets. A little soapy water applied to the fuselage first makes air bubbles push out from under the trim and a little heat helps on the curves. After drying out, the trim is as secure as ever. Cheveron Perfect Paint (spread with a brush) was used for the windows and anti-glare panel.

A three-line fuel system was installed with pressure coming from a tap screwed into the muffler. I placed the tap in a position that empties excess fuel straight out of the muffler during filling. This saves fiddling around at the field and prevents flooding. Make sure you turn the

motor over by hand before applying the electric starter! If all else fails, start the motor with the plane held securely upside down in a cradle.

FLYING. Chris Chianelli reports on flying the Cessna.

A real interesting thing about the full-scale 177: it'll do a perfectly fine spin, loop, and split S, even if Cessna Aircraft doesn't approve. Feel free to wring the scale model out a little bit without worrying about offending the scale purists.

The day of the maiden flight was an R/Cer's dream come true. Other than some unpredictable moderately gusty conditions, which was great for testing the tractability of the aircraft, the temperature was 68°, the humidity was low, and the sky was a true blue. A glorious day. After firing-up the Webra .40 ABC, a few minutes were needed to dial-in the low end mixture. An inverted engine is more sensitive to loading-up than a side- or vertically-mounted one. Once the setting was found, the Webra idled perfectly and throttle response was excellent. In all my years of modeling I've found few engines that have such good manners in the inverted position as the Webras; even starting without flipping the plane on its back can be accomplished most of the time as long as you haven't flooded the cylinder.

Taxiing the 177 even in moderate gusts was a pleasure, due in part to the low amount of dihedral. The takeoff run was straight as an arrow but when the 177 broke ground a gust got under the right wing of the as yet untrimmed craft and pushed the model left. Fortunately, the plane responded immediately to input and was never in danger.

After some minor in-flight trim changes, it became rewardingly apparent that the Aviomodelli 177 is a fantastic, groovy and stable trainer. And why not, with a wing area of 653 square inches and a low weight, for a model of this size, of 5 pounds, 14 ounces—that translates into a wing loading of 20.7 ounces per square foot.

The Cessna performed many slow passes and low sweeping turns for the camera, holding its own against the burbles caused by close proximity to the ground in spite of its supreme slow flight characteristics. The 177 has good penetration that is due in part to the sleek fuse and clean design.

The seasoned pilot will also have lots of fun with this bird. The semi-symmetrical airfoil, larger size and longer moments of the Cessna make for some nice rolls, loops, and stall-turns. At one point, our publisher, Louis V. DeFrancesco, Jr., barked the directive to "make inverted low passes—and hurry!" Not being one to question orders, I flipped the plane on her back and was quite surprised to find good roll stability and a minimum of down-elevator required for sustained inverted flight, a true statement of the fuse molding and, in particular, the wing saddle, which is responsible for correct wing incidence.

If you're a rank beginner, the Aviomodelli Cessna 177 with a good .40, like the Webra, is an excellent basic aileron trainer with lots more appeal in the looks department and less required work than the boxy balsa built-up kits. If you're a seasoned fellow, drop in a .60 and show them what a high-winger is capable of. As for me, this one's going on floats—it's a natural.

**The following are the addresses of the companies mentioned in this article:*

United Model Products, 301 Holbrook Dr., Wheeling, IL 60090.

PIC, Penn International Chemicals, 943 Stierlin Rd., Mountain View, CA 94043.

Sig Manufacturing Co., Montezuma, IA 50171.

J'TEC, 164 School St., Daly City, CA 94014. ■

ZINGER

(Continued from page 19)

Prepare to join the two wing panels by blocking-up the wing tips, 2 inches under each, measured from the bottom of the last rib. You'll have to trim the leading edge, trailing edge, and the spars at the wing center to allow for the dihedral angle. Not fit shear webbing to the center rib bays.

Bond the two center ribs to each other, forming one double-thickness rib. This rib must be cut in two, vertically, in the middle of the spar notches. Trim the rear section of the center rib as needed and bond in place. Shape the wing support block to fit snugly between the ribs and bond in place against the spar. Install the front section of the center rib, trimming as required, to clear the support block. Be sure to shape the support block to the airfoil contour and the dihedral angle as well.

The leading edge sheeting is now glued in place, top and bottom. Be careful not to build-in any warping during this procedure. Now add the trailing edge sheeting, top and bottom, followed by the center section sheeting. Capstrips are added to the top and bottom of each exposed rib.

Carefully sand the leading edge to a smooth contour. Install the torque rod set in the wing trailing edge followed by the two center pieces of aileron stock. Bevel the leading edges of the ailerons and trim them to fit in place and to conform to the profile seen on the plan.

Finish up the wing by adding 2½-inch fiberglass tape to strengthen the center section. Drill two holes through the wing as shown on the plan for the wing mounting bolts.

Start the fuselage by marking the location of all the internal parts (formers,

(Continued on page 100)

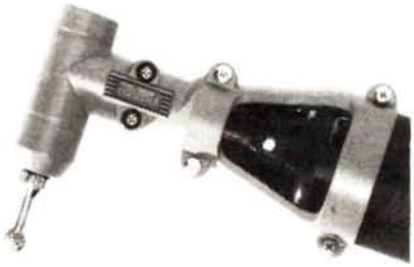
Product News

BLACK BARON, SORT-A'

The initial kit in the Sort-a-Scale series from Coverite (420 Babylon Rd., Horsham, PA 19044) is called the Black Baron Peashooter. It looks sort of like the Boeing P-26A, which was the first monoplane and the first all-metal fighter to wear U.S. Air Corps stripes. Unlike semi- and fun-scale kits, which require much of the detailed modeling demanded by true scale, the Sort-a-Scale series will be as quick and goof-proof to build as Coverite's very successful trainer, the Black Baron Special. They will be suitable for beginners who have learned to fly a basic trainer, and, in some cases, first-time builders. Like the Black Baron Special, the Peashooter uses the same convert-a-box system that converts an ordinary box fuselage into a sleek, round shape by the simple attachment of four molded-plastic parts—cowl, hatch cover, cockpit and turtledeck. The specs are: 56-inch wingspan; 560-square-inch wing area; uses .40 two-cycle or .46 four-cycle engine, and weighs 5 pounds.

AVIATION BOOK CATALOG

This book for the aviation buff has over forty pages stuffed with hundreds of books and posters to make any enthusiast drool. Extensive inventory includes books on Naval, WW II, jet, and other mililtary and historic aircraft from various countries. Listings for new releases and the Air War series are to be found. For more info contact Historic Aviation (3850 Coronation Road, Eagan, MN 55122.)



THE RIGHT ANGLE

The new Robart (310 N. 5th St., P.O. Box 1247, St. Charles, IL 60174) Right Angle Drive attaches to any Dremel Moto-Tool and certain Sears Craftsman and True Value Master Mechanic rotary tools. It lets the do-it-yourselfer and hobbyist drill, grind, and polish in places that are tight around corners or just not accessible without the "right angle." The Robart Right Angle Drive is precision-built with a rugged ABS housing, centerless ground shafts and lifetime-lubricated ball bearings. There are two models available—Model 420BB and Model 421, both with ball bearings. The Model 420BB is for all Dremel Moto-Tools except the newly released Dremel 395, 285, and 275 series Moto-Tools, which use the Model 421 Right Angle Drive.

GMP STORK

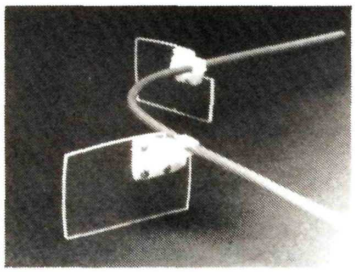
Gorham Model Products (23961 Craftsman Rd., Calabasas, CA 91302), in cooperation with Hirobo, has taken the latest example of a high-tech helicopter (BBC Stork) and customized it especially for the American market. It uses all of the latest R/C helicopter features, such as an advanced DDF rotor head (dual-damping/flapping), and advanced tooth-belt tail-drive system and state-of-the-art control system utilizing an in-line swashplate. The Stork Special Edition can be used with any of the usual .50 to .60 engines available in the U.S.

LOCTITE SILICONES

Two special silicone compounds have been developed by Loctite Corp. (4450 Cranwood Court, Cleveland, OH 44128) for modeling use. Clear Silicone Sealer is ideal for bonding as well as sealing. Use this wherever you would have used a household type sealer in the past. This formula dries faster and remains watertight. It also offers excellent adhesion to fiberglass and hardwoods. Loctite Hi-Temp RTV Silicone Gasket Maker is ideal for sealing mufflers to exhaust ports on any engine. You may also make any size or shape gasket in seconds. This formula is resistant to hot fuels and oils. Loctite Corp. has developed a Hobby and Craft Program especially for the modeler. These products have been approved for modelers' use and are available through the Sticky Group International.

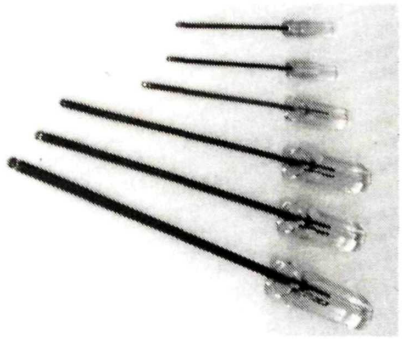
GOLD-N-CLEVIS

The Sullivan Products (1 North Haven St., P.O. Box 5166, Baltimore, MD 21224) Gold-N-Clevis has a spring steel retaining clip that won't allow the Gold-N-Clevis to open, even under heavy use. The welded center pin adds extra strength. The rolled, threaded collar with its interlocking seam cannot separate, yet still allows for accurate adjustment on 2-56 threaded rods. The Gold-N-Clevis is proudly made in the USA and is now available separately or as part of the Gold-N-Push Rod kit at a dealer near you.



CLAMPS

Designed to hold all Sullivan Products (1 North Haven St., P.O. Box 5166, Baltimore, MD 21224) Gold-N-Rod outer casings in place, our new Control Rod Clamps allow for easy installation and adjustment of control rod systems, without gluing. These clamps will fit most other control rod brands and include all hardware.

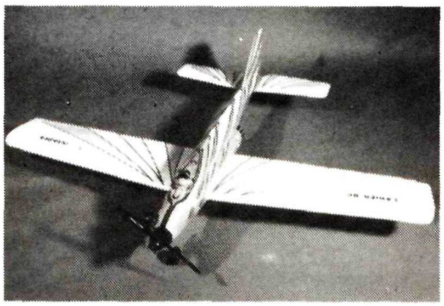


SIG BALLDRIVER

Sig Manufacturing Co., Inc. (Montezuma, IA 50171) is proud to introduce their new line of Balldriver hex tools. Quality-made in America from AISI-SAE 8650 heat-treated alloy steel, it allows the user to tighten securely without fear of breakage. All sizes feature nice long shafts that are perfect for all those hard-to-reach places. Sizes include: 9/64 inch for 10-32 socket head bolts, 5/32 inch for 8-32 socket head bolts, 7/64 inch for 6-32 socket head bolts, 3/32 inch for 4-40 socket head bolts, 1/16 inch for most large wheel collar sizes, .050 inch for most smaller wheel collar sizes.

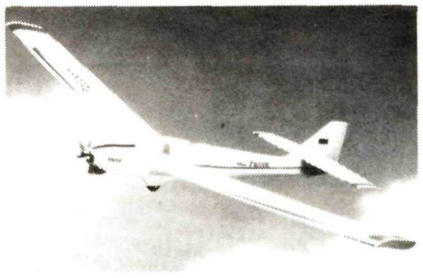
PIC STIC CYANOACRYLATE

PIC Stic Slow Cure Cyanoacrylate from Penn International Chemicals (943 Stierlin Rd., Mt. View, CA 94043) has the longest, most spreadable, best squeegee characteristics. Super thick, slow cure rate allows maximum fixture time to position and manipulate parts prior to cure initiation. Recommended for large surface bond applications such as fuselage doubler, wing sheeting, and laminating. Used in conjunction with PIC Pronto Accelerator, massive fillets can be formed easily. Bonds oily surfaces. Propriety chemistry has lower odor and does not brown with age, excellent open-time liquid characteristics that are important in sheeting.



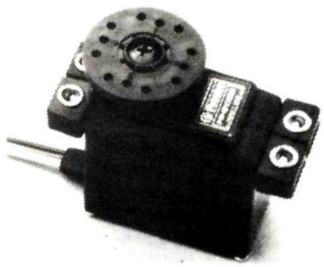
LANIER R/C INVADER

The Invader is a 90% complete .40 to .45 pattern ship with jet-like appearance. Features include prefinished ABS fuselage, pre-covered wings with Aero Sheet. The wings are also reinforced with plywood spars for added strength. All surfaces are covered with Aero Sheet, including tail surfaces. No painting or covering is necessary. The specs are: wingspan, 5 feet, 5 inches; area, 550 square inches; weight, 5 to 5½ pounds. Available in white, red, blue, yellow, orange, silver, and black. For more info contact Lanier R/C (P.O. Box 458 Oakwood Rd., GA 30566).



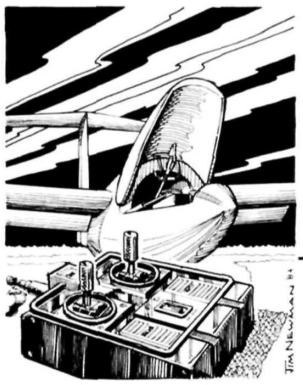
FALCON GLIDER

New from Robbe (180 Township Line Rd., Belle Mead, NJ 08502), the Falcon Motor Glider is ideally suited as a first model. It can be powered by an inexpensive .09 engine or outfitted with the recommended geared electric motor from Robbe. Stable flight characteristics, the hand-launch capability, and standard of prefabrication make it the right project for the beginner. The break-proof Plura fuselage, with the profiled balsa wings, stabilizer, and a high degree of prefabrication will get you into the air in a short time. Building errors are almost impossible because of the application of molded parts; covering isn't necessary. All small parts for control and rod systems, base coating, decorating set, adhesives, tools, drawings, and assembly instructions are included. Specifications: wingspan, 86½ inches; body length, 43 inches; wing area, 596 square inches; flying weight, about 4 pounds.



SERVO S135S (S35S)

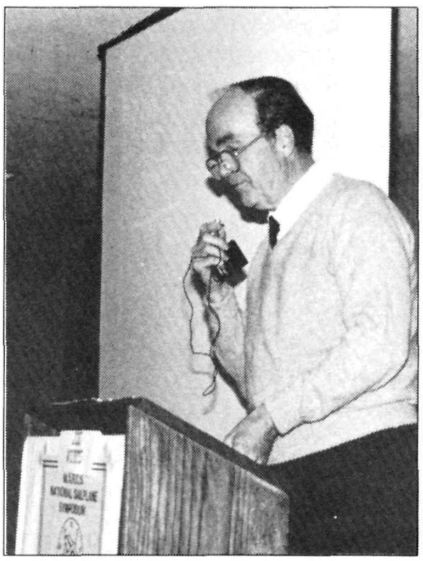
New from Futaba Corp. of America (555 W. Victoria, Compton, CA 90220), these servos do the work by operating and controlling the various functions of your model. Futaba provides servos with the size, power, and response necessary to operate almost any R/C kit. They feature a Futaba J connector (3-pin mini connector) and 1520us (1310us) neutral. A coreless mini-servo has metal gear/ball bearing output. Dimensions are 0.62x1.21x1.18 inches.



Soaring News

by JIM GRAY

BY THE TIME you read this, the U.S. World Championship, F3B Soaring Team will have completed its final practice sessions, and will be about to depart for Osnabruck, West Germany. There will be eight team members instead of the usual five, due to a favorable decision by the AMA and FAI. The five original members will receive travel compensation, and the three new members will pay their own way. At the time of writing, the members of the U.S. Team are: pilots, Steve Work, Richard Spicer, Steve Lewis; Manager, Phil Renaud; Assistant Manager, Seth Dawson; Field Operations Manager, Lynn King; Fund Raising Chairman, Thomas Thompson; Media Coordinator, David Williams; assistants, Richard Tilton and Don Edberg.



Dr. Karl Mohs opens National Soaring Symposium in Madison, Wisconsin, November '86.

There's already been some indication from the organizers of the World Championships that this will be the largest event ever held—29 countries represented, and including for the first time Soviet block nations, and possibly a Russian team as well.

The fund-raising effort needs help in the form of contributions! Here's how you can help your team: If you donate $5, you receive a special lapel pin with the team logo. If you donate $10, you receive a handsome jacket patch with the team logo. And if you donate $15 you receive both pin and patch. Please send all contributions to Tom Thompson, c/o USA R/C Soaring Team-F3B*.

In addition to contributions from individuals, corporate contributions are also welcome. There will be prizes awarded to persons who contribute through a prize drawing to be held before the team departs for Germany. Included will be radios, kits, materials and accessories, and possibly a FREE ticket to the World Championships!

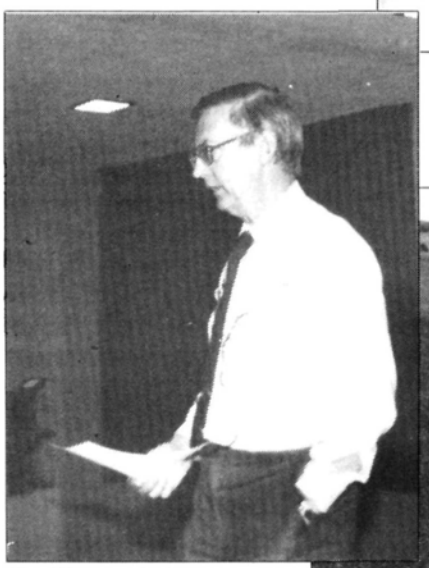
Maynard Hill, a true model aviation pioneer, reminisces about his world record attempts and electrostatic stabilizers.

Wally Phister reporting on some experiments concerning the strength of various types of wing structures.

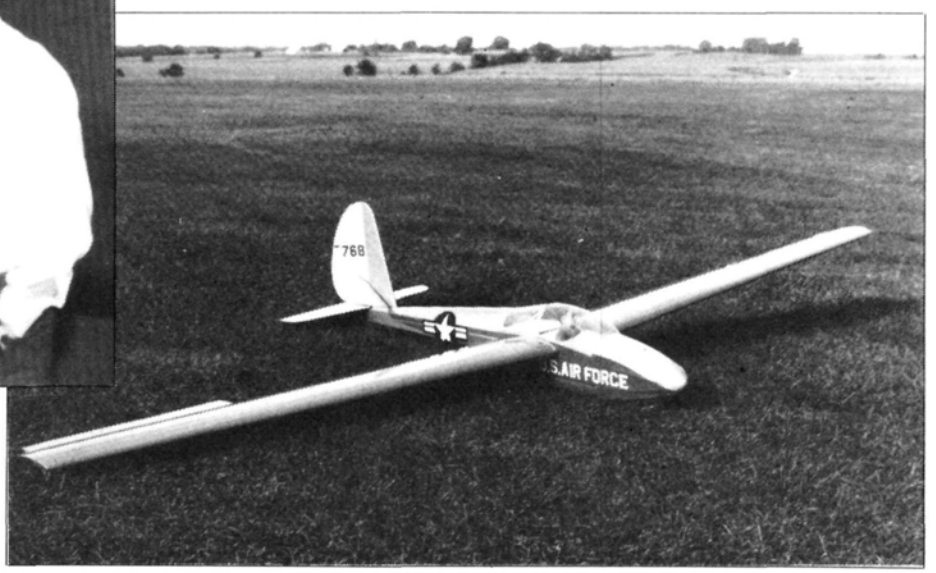
Obviously, of great interest to most of us is some information about what sailplane is to be used by the U.S. Team. The answer is not yet clear, but here are some possibilities: Synergy, Comet, and Eagle. The latter craft is a newly-designed one, which incorporates some of the best features of European F3B sailplanes, and a new airfoil developed for the purpose by Michael Selig. Mark Allen and Steve Work are working—so sorry—on this design.

Because of the late Dan Pruss' immense contributions to F3B both here and abroad, it has been decided to award a special trophy to the winning team in Dan's memory. It will be called the Dan Pruss Memorial Team Trophy, and will be awarded to the highest scoring team at the World Championships.

Joe Wurts gave a presentation on vacuum-bagging techniques for use with composite materials and structures.



Pete Waters, AMA Frequency Committee member, presented R/C frequency info.



Super-scale 1-26B by Steve Moskal. See text. Ship weighs 7.5 pounds with a 10-ounce loading. Photo by Dave Folkening.

While it is beyond the scope of this column to include all of the extremely critical details that go into the process of fielding a world championship team, I assure you that no detail has been left undone. The intent of the organizers and sponsors of the U.S. team is to bring back the team trophy to the United States., And it is the intent of each pilot to contribute his part by making the top score. There's spirit, organization, attention to detail, and sincere commitment by everyone concerned to field the best team ever sent to a World Championship!

Just between you and me, I have a strong hunch that the Eagle may be the sailplane to beat. But with the extremely sophisticated work that has gone into Synergy and Comet designs, either of these could become the next World Champion! As soon as details are available, I'll present them here.

As you read this, there may still be time to attend the final practice session on June 27th and 28th in Sunnyvale, California.

(Continued on page 119)

ZINGER

(Continued from page 95)

nose block, doublers, etc.) directly on the two fuselage sides, making one left and one right. Glue the ply fuselage doublers in place, being sure of exact location. Using the wing section drawing as a template, cut out the openings for the wings in each fuselage side, as shown on the side view. Next install the triangle stock longerons. The top longerons are flush with the top edge of the fuselage and the bottom longerons must be set back ⅛ inch to allow for the installation of the fuselage bottom. The triangle stock must be tapered down at the rear of the fuselage to allow the sides to be brought together.

Begin planning the exact location of your particular radio gear. Drill all of the necessary holes in the two bulkheads in the proper position for your equipment. The locations shown on the plan are only suggestions.

Glue the two fuselage sides to the rear fuselage bottom. This is best done by pinning the bottom piece to the building board and using the rear bulkhead to help keep everything square. The front of the fuselage will have to overhang the building board during this procedure. Next attach the front fuselage bottom in a similar manner. Now bond the bulkheads in place. Install the nose block between the fuselage sides.

At this time, install the outer control cable housings in place. Sullivan* brand cables are recommended. The cables should exit the fuselage about 2½ inches from the rear. Now sheet-up the top of the fuselage, making sure that the grain is run crosswise.

Cut the hatch block into a 2-inch long piece and a 5-inch long piece. Glue the 2-inch long block onto the top of the nose block, overhanging as shown on the side view. The 5-inch long block is now shaped to form the hatch, fitting snugly against the bulkhead. Glue the ply tongue to the front center of the hatch block. Drill a pilot hole in the hatch block for the 4-40 screw. Attach the ply hatch hold-down block into the fuselage. Using the hole in the hatch block as a guide, drill and tap the hold-down block for the 4-40 screw. No hold the hatch in place with the screw in preparation for shaping.

Glue-on the finger rest block to the step area. Slot the rear of the fuselage to accept the stabilizer and fin assembly. At this time, carve and sand all areas of the fuselage to a smooth profile and cross-section. Refer to the plan top, side, and section drawings.

Carefully cut the turtledeck free from the fuselage; it should be flush with the bulkheads. The two wing hold-down blocks are now glued in the fuselage with triangle stock under the front hold-down. Add the ply tail skid to complete the fuselage assembly.

Using the holes in the wing center as a guide, drill and tap the wing hold-down blocks for the 10-32 nylon bolts. Now bolt the wing into position. Slip the tail surface assembly into the rear of the fuselage and align the stabilizer with the main wing before gluing. Trim and fit the turtledeck to the top center of the wing, making it flush with the fuselage. Cut two holes into the turtledeck for access to the mounting bolts. Give the entire airframe a final sanding after using filler material to correct any imperfections.

Use a plastic material, such as Top Flite's* MonoKote, to cover the airplane. The control surfaces should be covered before they are installed. Very thin hinges are used, and must be secured in place with cyanoacrylate adhesive. These hinges are available from Radio South* and are called Pro Hinges. They're especially for use with cyanoacrylates. Each hinge should be cut into four pieces to make smaller hinges for this plane.

Install your radio using hardwood rails to mount the servos. You may have to vary from the positions of the components shown on the plan in order to fit your particular equipment.

Be sure to balance the airplane at the CG location shown on the plan. The glider will give the best handling if the CAR (coupled aileron and rudder) system is used. If your radio has this option, use a normal three-channel hookup and activate the coupling with your radio transmitter. If you don't have coupling on your radio, use a Y-adpater cable to connect the rudder servo into the aileron channel of the receiver. Use a 1:1 ratio of aileron throw to rudder throw. The recommended control throws are: rudder, 1 inch left and 1 inch right; elevator, ⅜ inch up and ⅜ inch down; ailerons, ¼ inch up and ¼ inch down.

FLYING. The first test-glides should be made on a calm day. I highly recommend the use of the CAR system, at least until you become familiar with the handling of the plane. Make several test glides in order to adjust the trim settings. Give the plane a smooth, level throw for

(Continued on page 102)

The Great R/C Design Contest

Sponsored by **Model Airplane News**, Hobby Shack, Airtronics, Midwest Products, Top Flite, and United Models.

Now is your chance to become a famous modeler!

The top five designs will be featured in **Model Airplane News** magazine as feature construction articles. All entries, however, will be considered for future construction articles, so get designing and building right now!

1st Place—$2,000 cash

2nd Place—$1,000 cash plus Hobby Shack EZ Laser, Airtronics, CS7P radio, and Saito .90 engine.

3rd Place—$500 cash plus Midwest Super Hots kit, O.S. .60 engine, and Airtronics radio.

4th Place—$400 cash plus Top Flite P-47 kit, Enya .60 engine, and Hobby Shack radio.

5th Place—$300 cash plus Midwest Hots kit, and O.S. .40 engine.

How to enter:

Simply submit a clear photograph of your model no later than June 1, 1987. Any type of model R/C airplane qualifies. Previously published or manufactured designs are not eligible.

Who decides the winner?

You do! The top designs will be determined by your vote. The September 1987 issue of **Model Airplane News** will have photographs of the models listed by number. Just send us a postcard with your favorite design listed and we'll take it from there.

Announcement of winners:

The December 1987 issue of **Model Airplane News** will feature a full spread of all the winners as well as a feature construction article of the 1st-place winner.

Be prepared:

Winners must be prepared to submit a complete construction article (6 to 8 typed, double-spaced pages), plus black and white photographs of the building sequence, full-size construction plans, and color slides of the model in static and flight conditions. Prior to the announcement of the winner, the publisher must receive verification that plans, photos, and manuscripts of the top five designs are available.

ZINGER

(Continued from page 100)

the test glides. Be warned that this glider is *very* responsive, so go easy on the stick!

When you're comfortable with the trim settings, you're ready for some power launches! The "grenade" style works best, but be careful not to smack yourself in the head with the wing or stabilizer. If the plane is trimmed out correctly, it will go exactly where you aim it. It should not balloon upward or tuck under. In order to get the maximum altitude, you should throw the plane at quite a steep angle, but be sure to level off before it loses airspeed and stalls.

You should note that the placement of the wing in the fuselage gives the glider a slight nose-down look when in level flight. Don't be afraid to push the nose down a bit more and really pour on the speed—this plane likes to fly fast. Once you fly into some lift, however, slow it down to take full advantage of the thermal.

If you wish, you can add a towhook for high-start launching, but I recommend that you use a lightweight elastic to avoid the risk of folding-up the wing.

The Zinger has excellent thermalling abilities, so be careful—this little plane can easily get to the outer limits of vision! If you do build some altitude, why not take advantage of the Zinger's outstanding aerobatic performance. Here is the time to use full three-axis control (not coupled) to do any maneuver in the book!

Good luck and happy soaring.

**The following are the addresses of the companies mentioned in this article:*

Sullivan Products, 1 North Haven St., P.O. Box 5166, Baltimore, MD 21224.

Top Flite Models, Inc., 2635 S. Wabash Ave., Chicago, IL 60616.

Radio South, 43 W. Nine Mile Rd., Pensacola, FL 32514. ■

CONTROL TOWER

(Continued from page 60)

when the back is off. With the elevator-aileron stick mechanics in view, the two upper left Phillips-head screws are for adjustment, elevator left and aileron to right. For rudder adjustment, note the two 3/16-inch diameter holes about one-third up the decoder board on the right side. The rudder adjustment screw is under the left hole. For all stick adjustments, clockwise movement makes the feel softer, counterclockwise stiffer. Well, that about wraps up the transmitter.

Moving on to the receiver, the first thing that struck me was its size. It measures only 1.38x2.42x0.8 inches and contains receiver, decoder, and a 5-plug receptacle. Cirrus advertises that the receiver has a 20 KH channel spacing, however, only one crystal is evident which indicates single conversion to 455K IF, so some additional filtering was being done. Lacking a schematic, I called Hobby Shack and they indicated that three filters are employed to provide enhanced signal purity.

The servos employed with the RC-5JK are the CS-238s with a hefty 49 oz-in. of torque, plenty for most moderately sized aircraft. I have included a summary of the salient characteristics of the transmitter, receiver, and servos, so that should suffice for performance stats. I would, however, like to talk about the Cirrus RC-5JK accessories and there are a bunch. First is the HS-FBC-8B(6) charger. It charges the 9.6V, 500-mAh transmitter battery and the receiver 500-mAh 4.8V battery at 50 mA together or individually. A unique feature of the charger is the use of just one light emitting diode (LED). First plug the charger into a 110V 60 outlet with nothing connected, then plug in the transmitter jack. Note the LED lights red. When the receiver pack is plugged into

(Continued on page 104)

CONTROL TOWER

(Continued from page 102)

the charger, the same LED turns from red to green. If you charge the receiver battery alone, the LED will glow a brighter green than when both receiver and transmitter are charging. Thus, to make sure you are charging both packs, plug in the transmitter first, get a red indication, then the receiver battery and the LED will turn green. After a couple of tries, it's easy. Charging time is nominally 15 hours.

Next are a color-coded frequency flag and an antenna mounting holder. A transmitter neck strap is also provided as are two servo trays, one for three servos plus an On/Off switch, and the other for the aileron servo. Lastly, there are a total of two splined horns, two with arms (4 and 6) and one wheel 1⅜-inch diameter with no holes and finally a switch harness.

I think Hobby Shack has another winner with the Wave 5. It is well made and packaged, and has many features found in considerably higher-priced sets. In particular, the gimballed sticks with electronic trim and adjustable feel are not normally available in sets sold at these prices.

I enjoyed this review and look forward to bringing you other new Cirrus radios in the near future, including a 5-channel PCM as well as a helicopter radio. See you next month.

Charlie Kenney, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728. ■

SMALL STEPS

(Continued from page 78)

"Years ago Cox offered an R/C conversion kit for their Medallion engines, consisting of two assemblies to be added to the stock motor. Component No. 1 was a bolt-on exhaust manifold which incorporated a pivoting baffle. This served somewhat the same purpose as the presently available Ace throttle sleeve. However there was a significant difference. As you know, nearly all Cox engines feature sub-piston air induction. That's why a carburetor such as the Tarno doesn't work well on a T.D.: if the air intake is restricted at the venturi by the throttle barrel, the engine merely sucks in more air under the piston skirt at TDC (top dead center). Thus the mixture gets messed up. On the Medallion R/C adaption kit, the exhaust manifold was somewhat pot-bellied in order to contain a volume of exhaust fumes around the exhaust ports. Then, when the case sucked in under the piston, it received exhaust mixture rather than clean air and thus enabled the intake throttle to work effectively.

"As for the intake throttle, it was much like the old Fox throttle setup for small engines. The rotating needle valve body (which was a replacement for the stock body) was large enough in diameter to nearly block the inlet passage. It had a pair of flats machined across its midsection, where the fuel metering hole was located. When rotated, if flats were in line with the intake, the passage was not restricted and the engine ran at full speed. Then, when you turned the needle body so that the flats came into the intake passage, it *was* restricted and the engine ran slower.

"The rotating needle body was linked to the exhaust baffle, so they both opened or closed together. The setup was quite difficult to adjust. Clamping the exhaust manifold in *just* the right place was a pain—sometimes when changing the glow head the manifold would end up in a different position."

There you have it. Perhaps the combination of the old Medallion R/C and the new Ace throttle sleeve is the answer....

See you next time.

Randy Randolph, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the person and companies mentioned in this article:*

Cox Hobbies, Inc., 1525 E. Warner Ave., Santa Ana, CA 92705.

Ace R/C, Inc., Box 511C, Higginsville, MO 64037.

Ralph Pearson, 118 Lister Ave., Falconer, NY 14733. ■

WRISTOCRAT

(Continued from page 51)

doublers to reinforce the fuselage around the stab pivot wire, at the base of the fin, and behind the wing trailing edge.

The Wristocrat definitely requires use of smaller radio systems. I installed Futaba's* miniature S-33 servo, micro four-channel R4H receiver, and their NR4G mAh battery pack. Following recommendation in the kit's instructions, no switch harness was installed—the battery is directly connected to the receiver prior to flight. This required making up a short

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WRISTOCRAT

(Continued from page 104)

male/male adapter, which took only a minute.

FLYING. Even with the addition of a third servo and the flap mechanism, the Wristocrat's complete weight was just slightly over 13 ounces, an excellent weight for a kit-built airplane in this category. Preliminary flight tests were run in sunny yet chilly January weather. As of this writing, I have accumulated approximately twenty flights using Craft-Air's* Upstart high-start system, and an equal number from hand-launches. The flights to date have shown that the incorporation of flaps significantly broadens the Wristocrat's performance capabilities. As I had hoped, slight reflexing of the flaps does indeed improve hand-launched performance. With a hard throw, the Wristocrat accelerates quickly without pitching up; neutral or slight down-flap during this transition eases the nose over into the glide. Using the high-start, a slight amount of down-flap provides the higher lift coefficients required for maximum altitude off the line. In either case, the Wristocrat's glide performance is excellent. Keep in mind that the Eppler 205 is not a floater airfoil, but must be flown at moderate speed for best performance.

Top Flite's Wristocrat is an excellent small glider for either sport-flying or competition. Overall, it is a well-designed small sailplane with excellent hand-launch capabilities, and good winch-launched performance. The Wristocrat was fun to build, and even more fun to fly. Hats off to Top Flite for another excellent product!

**The following are the addresses of the companies mentioned in this article:*

Top Flite Models, 2635 South Wabash Ave., Chicago, IL 60616.

Academy of Model Aeronautics, 1810 Samuel Morse Dr., Reston, VA 22090.

Pacer Tech, 1600 Dell Ave., Campbell, CA 95008.

K&B Manufacturing, 12152 Woodruff Ave., Downey, CA 90241.

Carl Goldberg Models, Inc., 4738 West Chicago Ave., Chicago, IL 60651.

Craft-Air, 6860 Canby Ave., #120, Reseda, CA 91335.

Futaba Corp. of America, 555 W. Victoria St., Compton, CA 90220. ■

GIANT STEPS

(Continued from page 93)

enough to permit landing. The only option was to fly on, hoping to run out of fuel before the flight pack battery went dead. But it didn't happen that way, and the model was destroyed. A larger airborne battery might have saved the model, but a kill-switch would certainly have.

With a kill-switch, a landing approach might have been set-up and the engine shut-down, resulting in a fairly simple dead-stick landing. Not to mention the fact that the engine can be shut-down in-flight in every emergency except a radio failure.

The kill-switch is most easily operated from low throttle trim, using a micro-switch. At any throttle setting above low trim, the engine operates normally. When a problem arises, the throttle is reduced to its lowest setting. Then the throttle trim is pulled back, and the kill-switch closes, grounding out the ignition and shutting off the engine. The sketch shows a schematic for the circuit.

The micro-switch is an inexpensive item available through Radio Shack or any electronic parts supplier. There is a number of different types available, but the one you need will have some sort of control operator attached to the switch button. Minimal movement is required to transfer the switch from open to closed. It can be operated by any convenient part of the throttle linkage and should be ahead of the firewall. Leading the ignition ground circuit back into the radio compartment may produce serious interference problems. If you must do so, be sure to check that this arrangement doesn't create problems for your receiver.

Micro-switches have three terminals, marked NO, NC, and O. These mean, *N*ormally *O*pen, *N*ormally *C*losed, and *C*ommon. For the kill-switch, the grounding lug on the magneto coil goes to the NO terminal. Then a lead is added connecting the C terminal to any convenient part of the engine casting. When the switch is transferred, the ignition is grounded and the engine stops. Very simple, safe, and convenient. Put one on your engine and fly a bit safer.

Another neat idea is one developed by Custom Electronics* of Alta Loma, CA. This system provides two R/C links between one transmitter and one airplane. To date, the system has been designed for the Kraft* and Futaba* systems. More are in the works, including a system for Airtronics*.

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GIANT STEPS

(Continued from page 108)

The product plugs into the RF module on the radio transmitter. Then two RF Modules plug into the unit. Two matching receivers are installed in the model. The signal from the transmitter is broadcast on both of the frequencies selected, using the one antenna. In the model, the stronger signal is selected, and the matching receiver applies the signal to the servos. The incoming signal is continually monitored, and should the signal fail, or degrade for any reason, the system then selects the other receiver and continues to control the model.

The heart of the system is the airborne error-switch which plugs in between the receivers and the servos. The output of the receivers is applied to the error-switch which monitors their quality. Should the stronger signal or receiver fail, or should interference take over, the error-switch instantly switches to the alternate receiver. The incoming signal is continually sampled and the error switch uses the stronger, and therefore safer of the two incoming signals. Neither receiver is master or slave, primary or back-up. A pair of LEDs on the error switch light show which of the receivers is in use; red for left, green for right.

If desired, you could use the same frequency on both RF modules in the system unit and receivers. While still subject to the interference, you'd have the security of a back-up if a receiver were to fail. Without going into a lot of technical detail, the system offers a considerable amount of protection from the more common radio failures.

You may also use one transmitter but two identical receivers in the model. When the two receivers are controlled through the error-switch, the better signal is always used, providing a degree of redundancy which is complete. Each of the two receivers is fully able to operate all of the servos in the model, so there is no degradation of control.

The error-switch only weighs 3.6 ounces, so it will add little airborne weight to your system. But remember, a battery dedicated to the error-switch is recommended, and its weight must be considered if it's going to be used.

Custom Electronics also manufactures an end-adjust unit which can be installed in the lead for a servo, and which provides a means of adjusting the end point of that servo. It's handy for those places where the end-point setting of a servo is critical. They also have a servo driver, which permits a servo to be operated without turning on the transmitter. It's useful for making adjustments, and checking control throw when it's not convenient to use your transmitter.

For additional information, drop them a line (include an SASE), and they'll send you a poop sheet that'll give you all the details.

Join me here next month for more information on the building and flying of our favorites, big models.

**The following are the addresses of the manufacturers mentioned in this article:*

Sig Manufacturing Co., Montezuma, IA 50171.

Midwest Products Co., 400 S. Indian St., P.O. Box 564, Hobart, IN 46342.

ACE R/C Inc. P.O. Box 511, Higginsville, MO 64037.

Custom Electronics, P.O. Box 1332, Alta Loma, CA 91701.

Kraft Systems, 450 W. California Ave., P.O. Box 1268, Vista, CA 92083.

Futaba Corporation of America, 555 West Victoria St., Compton, CA 90220.

Airtronics Inc., 11 Autry, Irvine, CA 92718. ■

WACO UPF-7

(Continued from page 31)

big stick moves gently back toward your belt buckle, the airplane is held a foot or so above the grass, and everything slows down. As the UPF sighs into the grass, it's moving no more than 45 to 50 mph, which seems like a brisk walk. Of course the pilot has to keep his wits about him, since the UPF will go wandering off one way or the other at any speed. A little inattention can generate some spectacular ground loops!

Just as the model airplane sport and hobby industry is being P-51'd to death, the same is true of the trusty old Stearman. Stearmans are ubiquitous, but the UPF is seldom seen on the flying scene. That's too bad. This is one airplane which would undoubtedly make a better model than it is in full-scale, if only because the control pressures can be brought down and the CG moved forward to make it easier to handle on the ground. Besides, you can paint it in the blue and yellow colors of the PT-14, and not one out of a hundred people will even know what a PT-14 is!■

ABOUT ENGINES

(Continued from page 41)

rpm. You then choose a propeller that allows your motor to rev up to 15,800 or so static; to allow for about 10% unloading in flight. Thus, your engine will be working at its maximum horsepower with this prop, and delivering its maximum thrust.

Sounds logical. But let's speculate a bit. What if you take that prop that lets your engine turn at its highest horsepower output, and hand-carve an exact duplicate, except as a "pusher" prop. This would do the same job of producing thrust as the original one, except in the opposite direction. So far, so good. Now let's carve a third propeller, exactly like the others in diameter and pitch and blade shape—except this time we'll make one blade a right-hander and the other a left. Now how much thrust will the engine deliver? Yet it will still run at its so-called optimum rpm.

Try large-size props at moderate revs for yourself. I think you'll like them!

Joe Wagner, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

HEL. ENGINE TIPS

(Continued from page 62)

the fuel to let it "seat" and to keep the engine cool during break-in. You can tell the engine is four-cycling when it sounds rough, has a large amount of exhaust smoke and generally doesn't produce the power it should. As the engine is leaned-out to a two-cycle setting, the engine will sound noticeably different. The sound will change to a higher pitch and become quite steady, the exhaust smoke will decrease and the power will noticeably increase. As the engine attains this two-cycle setting (called a "rich" two-cycle), it should remain set there for break-in if it doesn't have a ring, that is, if it's an ABC engine or some other new metal combination. The reason for this is that the engine must be broken-in at its normal operating temperature for the different metals to expand as designed.

The next thing we must consider is the basic design of the carburetor. Although each engine manufacturer has a design that they believe is best, most carburetors are basically the same in that they have both a high- and low-rpm mixture adjustment, with some also having a mid-range adjustment. It would be impossible to cover every carburetor on the market, but they all have similar characteristics and techniques I'll present should work on any carburetor.

As a general rule, the main needle-valve is used to adjust the mixture at full throttle, with the idle needle-valve having no effect. However, as the throttle is reduced to near idle, the idle needle-valve further restricts the fuel from the main needle-valve to slightly lean-out the idle mixture. This means that the fuel mixture at idle is controlled by both the main and idle needle-valve settings. It is the relationship between the main and idle needle-valves that makes the following adjustment technique work so well. Even if your carburetor is not of this basic design, this technique will still work, but may need to be repeated two or three times to refine the adjustments if the idle needle-valve does in fact have an influence on the high-rpm mixture.

The first adjustment will be with the main needle-valve, but we must start from an initial rich mixture-setting to prevent any damage from a lean run. Generally, closing the main needle-valve completely and then opening three complete turns will put it in a rich mixture-setting. Now start the engine and bring the helicopter into a hover, or at least light

(Continued on page 114)

HEL. ENGINE TIPS

(Continued from page 112)

on the skids, to ensure you're at a high-power setting. Confirm that the initial needle-valve setting does produce a very rich mixture, bring the engine back to idle, stop the rotor blades, and then close the main needle-valve one-quarter turn. Continue this process, closing the main needle-valve one-quarter turn at a time, not making any adjustments to the idle setting, until the engine is operating in a hover at a four-cycle for a ringed engine or at a rich two-cycle for an ABC engine.

Now that the main needle-valve is set, bring the engine back to idle, stop the rotor blades, and while holding the head securely, pinch the fuel tubing going to the carburetor. This will stop the fuel going to the engine, forcing the engine to run on only the fuel it has stored in its carburetor. To see if the idle mixture-setting is correct, pinch the fuel line for a few seconds; the engine should increase slightly in rpm for 2 to 3 seconds and then begin to die. If the engine does not increase in rpm before dying, the idle mixture is probably too lean. In this case, open the idle needle-valve only one-quarter turn and repeat the "pinch" process. If, however, after pinching the fuel line the idle rpm increases quite a bit and sustains for more than 2 to 3 seconds, the idle mixture is probably too rich. In this case, close the idle mixture only one-quarter turn and repeat the pinch process. Normally the idle mixture is set fairly close at the factory so it shouldn't take long to make these adjustments.

A rule of thumb is that it takes about a gallon of fuel to break-in an engine. After break-in, a ringed engine can be leaned-out to a rich mixture two-cycle setting, which is also where I prefer to run an ABC engine. Be carfeful to listen to the engine, rather than watching the amount of exhaust smoke, to determine if it's too rich or too lean.

If your engine has a mid-range mixture adjustment, it should be factory set, but may still need to be tweaked-in for proper acceleration between idle and full speed; this depends on how well the engine idles, accelerates and performs in flight. Further minor adjustments may be required, but by following this technique you should have a good-running engine in minimal time.

Once your engine is running properly, don't think it's going to stay that way. Different weather conditions from one day to another, changing your brand of glowplug, using a different fuel, etc., will make further adjustments necessary. Eventually, though, once you've mastered this technique, it will take only a couple of minutes at the beginning of each day's flying session to make sure that your engine is set correctly. ■

OPS 20-4 OHC

(Continued from page 57)

The main casting embodies the cylinder casing, crankcase, front housing and an integral radial mount. It contains a ball-bearing mounted crankshaft and a removable crank chamber backplate that, in turn, contains a roller bearing mounted, crankpin-driven rear shaft to which the 10-tooth bottom pulley is fitted. The upper pulley is keyed to the camshaft with a roll pin and the two pulleys are connected via a 9.5 mm wide toothed belt. The belt is partially shielded by the cylinder and head fins which are extended well to the rear of the cylinder, above and on both sides.

Like all OPS motors, the 20-4 OHC uses a chromed brass cylinder liner, but the aluminum piston is ringed. The piston departs from the usual flat head design insofar as it has cutouts on each side of its crown to ensure adequate valve clearance. Another feature which shows OPS two-stroke influence is the carburetor which, instead of having a semi-rotary barrel type throttle valve, is of the slide-throttle type. It is fixed to the top edge of the engine mounting flange and has a bellcrank type throttle arm to provide a direct push-pull linkage to the throttle servo.

Clearly, the OPS 20-4 OHC is one of the less orthodox single-cylinder model four-stroke-cycle engines on the market at the present time but, having regard to its overall design, it is reasonable to suppose that it will be fully competitive performance-wise. OPS claims a power output of 2.1 horsepower at 12,000 rpm, which is something that we hope to check out in due course. If confirmed, such output figures would, in fact, put the OPS in direct competition with the similar sized Enya R120-4C and O.S. FS-120 "Surpass," both of which, coincidentally, are also rated at 2.1 bhp at 12,000 rpm.

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

R/C NEWS

(Continued from page 81)

touch. It cleans off easily with soap and water.

Skin Shield is modeling chemistry at its best. PIC saw a problem and formulated a solution. I don't pretend to understand why this stuff works (after all, it's a bit mind-boggling to see something that prevents skin bonding but doesn't bother bonding of wood). I can only say it really works. If you're tired of carrying your latest fuselage to the dinner table (because you're so "attached" to it), try PIC's Skin Shield!

My other major problem: I'm tired of gluing my shoes to the workshop floor. I do that a lot. Perhaps we need "Shoe Shield"; or maybe "PIC Apart," a fine cyanoacrylate debonder.

My Pick for 1987's Best Name

Sig* has had great success with their Kadet Senior. And well they should, this is a trainer that permits a beginner to learn R/C flying with virtually no help at all. Along with that, upon purchasing a Kadet Senior, a beginner has paid the fee for a model building course that will teach him most of the tricks of the trade.

I've discussed that .40-cid-powered trainer in past columns; it's a fine airplane—one of the best for training and sport flying. Fired by the success of the big Kadet Senior (and requests for one that would better fit small cars), Sig has developed a smaller version.

So, what to call it—Kadet Senior-Junior? Perhaps even Kadet Mini-Senior—it's a problem when one starts with a "Senior" designation.

It was no problem for Sig. The smaller version of the Kadet Senior is called the Kadet *Seniorita*! And that is the Kadet Senior in a 63% version. This newest Sig trainer carries a .20 engine and offers the same building course and ease of flying as its big brother. Seniorita may be very close to a perfect trainer and one that any beginner should consider.

A Neat Idea

From time to time, I've had glowplugs shut down on my .60 four-stroke in idle. To avoid this, I've made up a micro switch at the throttle servo with fairly long leads to the glowplug. The system was fussy and, apparently, overly complex.

A better way to go comes from A.J. DeVorss and it appeared in the *Jefco Flyer* of the Jefco Aeromodelers:

"Are you having trouble keeping your four-stroker running at idle speed? Would you like to have a fool-proof switch for your on-board glow battery? It is easy to adjust, it won't get oily and fail, and, best of all, it won't cost anything because you already have one at home somewhere.

"Simply install your on-board battery in a convenient place in your plane, run one lead (it doesn't matter which one) to the glowplug, then attach the other lead to the throttle pushrod any place convenient. Close to the engine, solder a safety pin (minus the clasp) onto the pushrod in such a way that one leg of the pin will contact some metal part of the engine as the throttle rod approaches idle.

"The throttle pushrod has to be electrically insulated from the engine (it should be already). I set my safety pin spring so that it engages at about three clicks. Also, don't forget to open the throttle after shutting off the engine or the battery will continue to light the plug."

I tried it and it works great.

Art Schroeder, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Penn International Chemicals, 943 Stierlin Rd., Mountain View, CA 94043.

Sig Mfg. Co., Montezuma, IA 50171. ■

HELICOPTERS

(Continued from page 73)

will heat it, causing it to melt and grab the shaft, stopping the tail rotor.

When you actually attach the drive shaft to the output gear and tail rotor transmission, be sure that you don't cock the tail joints with the setscrews. After you've tightened the setscrews, rotate the joint and check for any wobble. If any occurs, loosen the setscrews and re-tighten them to be sure that the joint will remain straight. Also be sure to apply a thread-locking compound to the setscrews.

Before you tighten the tail boom down, check the tail rotor transmission to be sure it's 90° to the main frames, so that the tail rotor blades will be running straight up and down. Make sure that the tail boom clamps have enough grip to keep the transmission from twisting in the boom. I've been drilling 1/16-inch holes in the clamps and using sheet-metal screws to lock the transmission in place. This seems to be the best fix for the problem and allows you to re-use the clamp.

Be sure to get smooth operation of the tail rotor pitch change mechanism. This control cannot tolerate any binding or

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HELICOPTERS

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slop. There's a fine line between the two conditions, and this is very important to the performance of the helicopter. I think of the tail rotor as the front end of a car. If the parts are worn and sloppy, you won't be able to steer straight without constantly working the steering wheel.

The helicopter will not trim out if the tail rotor cannot be accurately adjusted, or if the blades don't return to the same center after they've moved. This fact holds true for all control linkages, which brings us to the next step: radio equipment installation.

Begin the radio equipment installation by attaching all of the servos to the servo trays. Be sure to use the rubber grommets and brass eyelets included with the servos whenever you're screwing the servos to the trays. These parts help protect the servo from vibration without too much movement, so that the control returns to the same neutral after each use.

If you're building a kit which provides the servo-mounting screws with shoulders on the nuts, be sure the screw passes up through the metal servo tray and then through the servo grommet, with the nut placed into the grommet from the servo side. Do not use the brass eyelets with this type of installation, as the shoulder nuts replace the eyelets. Check the servos to be sure that you have them facing in the proper direction, since the output shaft of the servo is offset from the center. Careful study of the drawings will show how each servo is intended to be placed. Finally, check for correct servo direction before screwing them into place.

In some cases, you might need to use a reverse servo to make the control function correct on the transmitter. Most of today's radio systems have servo-reversing switches on the transmitter, which make this step practically obsolete.

However, if you don't have servo-reversing, your system most likely includes one or two reverse servos. It's necessary to plan your setup so that all of the controls will move in the proper directions. Most construction manuals for today's kits will include instructions which show correct servo movement. But, I'll cover it briefly here.

The following directions are for a dual-stick mode, two-radio system. Left stick: the left stick controls three servos: the throttle servo, the collective pitch servo, and the tail rotor pitch servo. When the left stick is moved up and down, it controls the engine (throttle) and the collective pitch.

Moving the left stick to the lower position decreases the throttle and the collective pitch. Moving the left stick to the upper position increases the throttle and collective pitch. The hover point on the left stick should be in the center of travel.

Moving the left stick to the right will make the nose of the helicopter move to the right. This means that for a clockwise main rotor rotation (most models have clockwise rotation), and when the tail rotor rotation is clockwise, the tail blades will increase in pitch for right tail rotor control.

The right stick controls the cyclic roll and cyclic pitch controls. When the right stick is moved from the lower to the upper position, the cyclic pitch is changing. The neutral position for the right stick is always in the center, which is why the stick has centering springs built in.

Moving the right stick to the lower position will make the swashplate move aft, which will cause the helicopter to move backward. Moving the right stick to the upper position will move the swashplate forward, causing the helicopter to move forward.

Moving the right control stick left and right changes the roll cyclic. Moving the right stick to the right makes the swashplate move right (when viewing the helicopter from the rear), causing the helicopter to move sideways and to the right. Actually, the motion is more like rolling to the right, which is why this axis of movement is called the roll cyclic.

Moving the right control stick to the left will drop the swashplate to the left which will cause the helicopter to roll to the left. Don't set your machine up any differently than this if you intend to get help from other fliers. The only exception to this would be if you are a mode one flier, or if you are using a single stick radio. Mode one fliers will know how to convert these instructions for their purposes, while only a few changes are needed for single-stick work.

Proper installation of the radio equipment is perhaps the most confusing area for the first-time helicopter builder. Often, the drawings won't show every angle and some areas are left to conjecture. Study the photos in this article and look at photos of other helicopters if you're confused as to just how things get hooked up. The three most complex controls are the collective pitch, cyclic pitch, and the roll cyclic. This is because these controls affect the rotor head, which requires a series of linkages to connect the rotor head to the servos. Let's take a look at a

typical collective pitch setup.

I covered the basic assembly for the collective pitch mechanism last month. Now it's time to connect this mechanism to the collective pitch servo.

Once again, be sure the mechanism works very freely, yet has no adverse slop. There are several methods of collective pitch control on the various kits available, so I won't get into the differences.

Basically, you'll want to set the output of the servo so that the arm extends straight out from the servo with the left stick in the center position. This prevents the servo from having a differential throw which would allow more travel at one end of the throw than the other. For the time being, we'll try to avoid any differential throw in any of the controls.

Next comes pitch and roll cyclic servos. Again, be sure that the servo arms extend straight out from the servo with the right stick in the center position. These two controls will usually be linked to bellcranks which connect to the swashplate. You'll want the bellcranks to be set so that one arm is exactly parallel with the main shaft. Do this by adjusting the length of the control rod from the servo. Next, connect the bellcranks to the swashplate with another control rod. The swashplate should be level when the right stick is in the center position. This is attained by adjustment of the second rod length.

The two remaining controls are simpler because they normally link directly to the servo that controls them. The throttle linkage should be set so that just past half the throttle barrel is open when the left stick is in the center position. There should be enough travel to allow the throttle barrel to open completely. The throttle barrel does not necessarily need to close completely. The only real requirement here is that the engine speed drops below clutch engagement when the throttle trim is reduced to full low. Some experimentation is usually in order here. If you can still get the engine to idle dependably at about half of the throttle trim, and get the engine to stop with the trim all the way in the low position, I think that's the ideal situation.

The tail rotor pitch control will wrap up our coverage on kit construction for this month. Route the tail rotor pitch control along the tail boom and past the mechanics. Be sure to secure the linkage at several points. This linkage usually has an outer housing that can be taped to the tail boom and clamped to the mechanics. This is critical if the rod has any opportunity to flex.

I was once flying a model for a beginner who had not secured the tail rotor pitch linkage to the tail boom very well. Every time I tried to push the nose of the copter against the wind, it would jump the opposite way. I thought it was a radio problem because the movement was so violent. The force on the tail rotor system actually bent the linkage enough to give an opposite command. A couple of wraps of electrical tape around the tail boom solved the problem.

Also check the linkage to be sure that it doesn't rub on any rotating parts. This could cause a failure. As mentioned earlier, it may be necessary for you to use a reverse servo on the tail rotor pitch control if you're using a gyro, regardless of whether or not you have servo-reversing in the transmitter.

When installing the gyro, be sure to check for the proper operation and direction. If the gyro operates backward, you can't reverse this by just reversing the tail rotor pitch servo at the transmitter. I'll go into more detail in a future article.

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HELICOPTERS

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Next month I'll cover the installation of the rotor head, rotor blade balancing, and final assembly of the helicopter. Keep working on your radio installation until you're satisfied that it's correct. It's a vital part of your machine's operation.

Until next month, keep checking your machines for any loose nuts, bolts, and setscrews. It just might prevent a crash.

**The following is the address of the manufacturer mentioned in this article:*

Loctite, 18731 Cranwood Pkwy., Cleveland, OH 44128. ■

SOARING NEWS

(Continued from page 99)

Contact Seth Dawson* for further details.

For those of you who attend a team practice session, remember not to fly your own sailplane until the team practice is over. So far, excellent times have been posted by Comet and Synergy, but the Eagle has yet to fly due to some delays in preparing the molded fuselages. With luck, these can be overcome soon, and the new sailplane flown at least in one, possibly two, practice sessions. Airfoil development so far has shown that the 'foils used at the team selection finals will be hard to beat. And unless radical improvements develop, the earlier profiles will be used. Six identical Synergy sailplanes are now being built.

The specifications of the Synergy plane follow. Wing construction: A vacuum bagged wet lay-up with unidirectional carbon-fiber root to tip. A unidirectional S-glass leading to the trailing edge, with a unidirectional E-glass doubler tapering to 40 inches. The leading edge is molded composite. The spar is molded carbon-fiber, and the root extention forms joiners. The stabilizer and rudder are vacuum-bagged wet lay-up E-glass. The fuselage is a lay-up of a combination of E-glass, Kevlar, and carbon-fiber.

Airframe construction designed to withstand 44-G loadings. All radio equipment is contained within the fuselage. The torque tubes activate aileron and flap control surfaces. Ballast box is located over the CG in the fuselage. (Up to three pounds ballast can be added.)

This seems to be the month in which all of the contest information comes together in one article, so stand by for more.

Dash for Cash, the Central Ontario Glider Group (C.O.G.G.) announces its '87 Dash for Cash—the 7th held so far—going on from July 16th thru 20th, 1987. The 16th and 17th of July will be practice days, and the 18th through 20th will be contest days. This year, the Dash for Cash has been accepted by the FAI as an International F3H contest, i.e., cross-country under the FAI rules.

Before F3H becomes a World Championship category event, there have to be six FAI-sanctioned contests. The first was held in South Africa in 1985. The second will be held in Canada this year. The rules state that at least two countries must compete. The Canadian Nationals will be held July 22nd thru 24th for sailplanes, providing a full week of flying for anyone attending both meets. Neil Tinker* will provide an information package for anyone who is interested. Jack Nunn will be director of the Dash for Cash. The Canadians are making every effort to see Dan Pruss' dream of F3H become a reality, so pack up your new 15-footer cross-country machine and write to Neil to reserve your slot.

S.O.A.R.

S.O.A.R., once again is sponsoring its annual Great Race. This AMA-sanctioned cross-country event will be held June 13th and 14th, and will mark the

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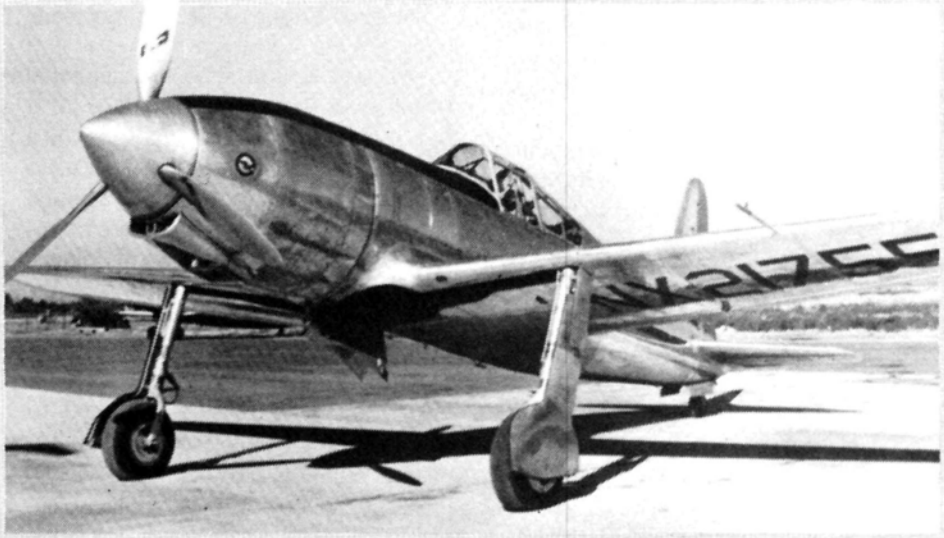
NAME THE PLANE CONTEST

Can you identify this aircraft?

If so, send your answer to Model Airplane News, Name the Plane Contest (state issue in which plane appeared), 632 Danbury Rd., Wilton, CT 06897.



The Cloudster was touted by Douglas Aircraft as having all the safety, speed and luxury of a modern airliner. It was intended for either charter service or for executive use. Two 250-horsepower engines were mounted inside the fuselage behind the sound-proofed passenger compartment, which drove a single 8-foot propeller aft of the rear control surfaces. Plane can carry five persons plus 250 pounds baggage a distance of 950 miles at 200 mph.

Congratulations to F. Higgason of Santa Barbara, California, for correctly identifying our mystery aircraft. Other correct answers came from F. Wolfe of Fort Worth, Texas, and David Schreiner of San Antonio, Texas.

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to Model Airplane News. If already a subscriber, the winner will receive a free one-year extension of his subscription.

SOARING NEWS

(Continued from page 119)

11th Great Race. As in 1986, SCALE will be included, using AMA sport scale rules. As you know, the Great Race is a *team* event, so pick your partners now, and send in your letter of intent to S.O.A.R., 23546 West Fern, Plainfield, IL 60544. You'll receive the official entry form and a set of rules for entry and flying. This must be received (postmarked) between April 1st and April 30th.

Anyone wishing to enter an FAI-sanctioned meet, such as an F3B or F3H contest on an International level, must have an FAI stamp affixed to their national aeroclub membership card. Contact the AMA for procedures on having this done. U.S. Nationals—will be held in Lincoln, Nebraska in 1987. The S.O.A.R. club has stated its intention to sponsor an award to be given at each Nats in memory of Dan Pruss. A check in the amount of $2,000 has been forwarded to the AMA as the initial endowment.

For many years, this club has been one of the pre-eminent clubs in the country. It was Dan Pruss' home club. It is understandable that S.O.A.R. has actively sponsored so many awards, trophies, contests, etc., in Dan's memory.

This year another of Dan's hopes will be fulfilled with yet another contest: S.O.A.R.'s Scale Uprising to be held August 1st and 2nd at the S.O.A.R. sod farm flying field at Oswego, Illinois. Events such as Sport Scale, AMA thermal duration, Speed (for pre- and post-1946 scale models separately) will be included. Classes of model will include Military, Primary/Hang Glider, Flying Wing, Motor Glider (the model, not the full-scale subject) to be electric-powered, pre- and post-1946 Sport and more. Special awards will be given for the oldest subject, the best scratch-built model, and the best model built from a kit, the best documentation, and the best technical achievement in realism.

The contest director will be Jim Slater, and the contest coordinator will be Steve Moskal*, who is the person to write to for information and entry blanks. Preregistration deadline is June 1st.

The Schweizer 1-26 shown in the accompanying photo is the work of Steve Moskal, who is a long-time member of the S.O.A.R. group and a club officer. His scale models have been entered in numerous contests and have won prizes at most of them.

The 1-26 is scratch-built at ¼ size and covered with aluminum Super MonoKote. The red leading edge is also Super MonoKote. K&B SuperPoxy was used to provide the red fuselage trim. SIG decals provided the Air Force insigna, and vinyl rub-ons provide the nomenclature.

This fine-looking machine weighs 7.5 pounds and has a wing area of 1,500 square inches, giving a wing loading of about 10 ounces per square foot. Jack Hiner, another S.O.A.R. club member and one of its finest scale modelers, has flown Steve's 1-26 and pronounced it docile yet maneuverable. The airfoil is a

Club of the Month

The R/C Barnstormers of John County, Kansas, is the *Model Airplane News* "Club of the Month" for June. Steve Milam is president of the club, and Carl Melin edits its "Fly-Paper" newsletter.

The Barnstormers held a static contest in March. There were two categories of entry: experienced and beginner. Cash prizes and dues wavers of $15, $10 and $5 were offered for first, Second and Third place winners respectively. For the struggling modeler, a static contest can bring the same sense of accomplishment as winning a big event.

A static contest can also serve to let the public know about R/C. Another static contest, at the Metcalf South Shopping Center, used a large-screen TV and a VCR for educational purposes. The public is becoming more and more tuned in to R/C through events such as these.

A soaring event is also being arranged by the club. This is to be a low-pressure event. Gordon Williams, in talking with Paul Holsten of Ace R/C, is letting his club know that there is a group of people trying to promote a Western Missouri/East Kansas soaring society. Gordon's impressions are that everyone would have a lot of fun, without the pressure that is so common in a contest atmosphere. "Low-key" is the name of the game.

It's apparent that the R/C Barnstormers are the kind of guys who reach out to R/Cers and endeavor to educate others in the name of furthering the sport—and we salute you!

Each month Model Airplane News will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). Model Airplane News will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletter to Model Airplane News, Club of the Month Contest, 632 Danbury Rd., Wilton, CT 06897.

Stan Watson Pegasus 13% airfoil for the wing, but a scale airfoil for the empennage. Three servos provide four functions: coupled aileron/rudder, elevator and tow hook release. The hooks don't show up in the photo, but are located at the bottom of the spar on each wing. A bridle is used to provide extremely stable tows. All horns and actuators are internal to preserve the scale appearance.

Steve says that the hardest part of the entire project was carving the 9x6-inch canopy plug, and then finding somebody who would pull some test shots from plastic. It all worked out very well, indeed. Steve that there are no plans at present, but there may be in the future if it is popular enough, if flight tests continue successfully, says and if a sheeted-nose version can be worked up—to save wear and tear on the fuselage during landings and to better simulate the popular C and later versions of this Schweizer classic. Earlier versions had steel-tube and fabric covered fuselage structures whereas the later versions finally became all metal.

National Sailplane Symposium

Al Scidmore provided some interesting photos of the November '86 symposium, which by any standards was the best to date. This fourth annual event was held on November 1 and 2 in Madison, Wisconsin. Al said that Joe Wurts arrived early on Friday morning and by afternoon Al had him out on the slope soaring Al's ½A pylon racer with engine removed. Later, a group of early-bird arrivals was taken to the local National Guard hangar and shown around the A-10s of the Madison, Wisconsin, ANG squadron.

The symposium has grown steadily since its inception four years ago and has achieved national recognition as one of the premier events for sailplaners. Speakers came from Florida, New York, Virginia, Maryland, Ohio, Michigan, California, Oregon, Iowa, Minnesota, and Illinois. Some 106 pilots registered for this year's meeting and they truly came from Maine to California.

The subjects covered this year were as varied as the speakers themselves. Walter Good showed us some of the research he has done as far afield as Germany on the earliest controlled R/C flight—would you believe that the rudder was actuated by heating a wire which caused it to lengthen, allowing a rubber band to pull the rudder over. Maynard Hill, who has held more world records in R/C than anyone else, told us of the excitement and the frustrations of doing world record attempts for distance and duration and speed, all power models. His accounts of the physical difficulties of setting international records, which stipulate that the flier must keep hold of the transmitter at all times, had us all rolling in the aisles. Joe Wurts came from Los Angeles to tell us about the easy way to make glass wings with a vacuum bag technique, equally applicable to power and sailplane alike. Tom Brightbill let us in on some of the ways he prepares himself to be a contest winner, and what a winner he is! John Grigg, our AMA president, led a discussion of F3B, the international sailplane event. He was assisted by Bob Sealy and Terry Edmonds. Warren Plohr and Peter Waters brought us up to date on the radio end of the hobby. Jeff Troy, now employed at AMA headquarters, led a panel discussion about contests with Cal Posthuma and Bob Sealy. Gary Tschautscher and Willy Pfister used their German heritage to bring us reports of experiments in Germany. All in all, a terrific program with something of interest every hour. Eighty-nine attended the banquet at CJ's East and heard the interesting story of flying a sailplane in the wave over Pike's Peak to 30,000 feet, by that intrepid Englishman, Oliver Smithies.

The committee who produced the symposium for MARCS: Al Scidmore, Walt Seaborg, Bill Vogelsang, Dan Farwell, Tim Warden, John Lusk, Tom Lazar, Frank Baker, Joe Imilkowski and Carl Mohs. Each member contributed to a smooth, trouble-free event.

The Saturday meeting opened with a talk by Walt Good, who set the pace for the next two days of learning and fellowship. CD Bob Sealy followed with a report on the F3B team selection finals and this set the stage for a panel discussion of the future of F3B in the U.S. conducted by John Grigg and assisted by Terry Edmonds and Bob Sealy. The symposium participants showed interest in the possibility of running F3B—like participants showed interest in the multi-task events and helped prepare the contestants for advancing to the full international F3B-type aircraft.

Tom Brightbill gave a talk on flying the advanced straightwing models so popular in the Northwest and gaining in popularity elsewhere. His thoughts on the development of the proper attitude for contest winning hit home. Who among us hasn't mentally given up after a bad flight early in the contest! Maynard Hill gave one of the outstanding talks of the meeting on the electrostatic auto-pilots and brought down the house with his word pictures of the physical difficulties of

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Classified

RAZOR BLADES: Single-edge industrial quality, super sharp. 100/$4.75, 200/$9.50, 300/$14.25, 500/$23.50, 1,000/$46.00; add 10% postage west of the Mississippi. Cobbie's Gifts, Box 2, Deal, NJ 07723; 201-922-9898.

WANTED: RTF U-Control planes from Cox, Wen-Mac, Comet, Aurora, Testors, etc., complete or pieces, buy or trade. John Fietze, P.O. Box 593, Lynbrook, NY 11563.

ANTIQUE MODEL IGNITION ENGINES—PARTS CATALOG, 50 pages, precision cast timers, original cylinder heads, point sets, drive washers, tanks, for GHQ, O&R, O.K., many others. Large catalog $4.00 pp. Chris Rossbach, RD 1, Queensboro Manor, Gloversville, NY 12078.

HARDWARE AND SOCKET HEAD cap screws, all sizes, low prices. Write for complete list. Example 6-32x1" only $4.25 per hundred. Micro Fasteners, P.O. Box 42A, Netcong, NJ 07857.

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; 918-245-3649.

BEGINNERS, discouraged by too-fast R/C "trainers"? Send $1 and a stamp for no-holds-barred evaluation of over 20 well-known models rated for their ease-of-flying. James Waterman, 3818 Deerfield Dr., San Antonio, TX 78218.

BOOKS FOR MODELERS. Out-of-print/current, 400+ items list $1. John Roby, 3703B Nassau, San Diego, CA 92115.

PRIVATE COLLECTION: Hundreds of aviation magazines for sale—*Popular Aviation, Flying, Model Airplane News, Air Trails, RAF Flying Review, Wings,* and many others. 1932-1960. All in excellent condition. Send $2 for list. William C. Fort Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

SCALE DOCUMENTATION: PLAN ENLARGING. Photo packs, 3-views, drawings for 1,600 aircraft. Super-scale R/C plans for Giant, Sport; 43-page catalog $3. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; 919-292-5239.

JETEX ITEMS AND KIT WANTED for cash. Kits by such makers as American Telasco, Berkeley, Comet, Cleveland, Monogram, Tailored, and others. Paul Williamson, 5032 S. Ridgeview, Nashville, TN 37220.

HUGHES 500DE, JET RANGER heli fuselage, replace those unsightly holes of cutout windows with an Air Screen Kit, finish with a professional look, order now! Kits $5.45, $1.50 postage, information brochure $1.00, to Alvin Harris, P.O. Box 3462, 1018 E. 23rd Ave., Tampa, FL 33601.

NYLON MACHINE SCREWS, nylon wire ties, reusable polyetylene glue guns. Nylon hex nuts, cap nuts, wing nuts, washers. Nylon hex head cap screws. Domestic and metric. Quantity discounts. Free catalog. Transmotions Inc., P.O. Box 160, Dept. M, N. Hollywood, CA 91603-0160.

ENGINE COLLECTORS: Spark ignition and old diesels for sale. Riccardo Taccani, CP59, 6834 Morbio INF Switzerland.

WANTED: *Flying Aces, Model Airplane News, Air Trails,* 1920s-1950s. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

AERO CLUB OF ISRAEL needs your support for aeromodeling activities. Send SASE for Newsletter. Friends of the Aero Club of Israel, 147-02C 29th Ave., Flushing, NY 11354.

WANTED: Drone Diesel Engine. Running order. Will pay top money. Gene Chesser, P.O. Box 993, Nice, CA 95646.

AIRCRAFT RESEARCH: Need rare aircraft documentation, photos, three-views? Send requests with $1.50 U.S. for sample information. Mr. I.A. Ross, 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

BUY, SELL, OR TRADE: Model airplane engines, magazines, plans, etc. Phone 906-478-6081 or SASE to Harvey Hafner, Box 11, H40, Rudyard, MI 49780.

MAGAZINE COLLECTION: *Model Airplane News, Flying Aces, Air Trails, Popular Aviation,* etc. 1932-1960. Comprehensive lists, individually priced with collector condition rating for $4. Dick Hill, 8826 John Dower Rd. S.W., Tacoma, WA 98499.

BUILDING BOARD: Flat, warp resistant, pinnable surface, 16"W, 48"L. Free brochure. Limestone Enterprises, Box 586-MA, Athens, AL 35611.

ELECTRIC KITS & EQUIPMENT. Specializing in Astro Flight systems. Catalog $1. CS Flight Systems, 31 Perry St., Middleboro, MA 02346-3117.

FIBER-OPTICS: Put a little light in your plane. Flexible, fun, safe, and simple—no model shop should be without some! Hundreds of uses! Fifty feet (enough for the kids, too) of high quality, flexible, versatile, 20 mil continuous fiber-optic strand (including some useful hints): $5 postpaid. Handikits, Box 143, Hatboro, PA 19040.

WANTED: 1930s Ideal Model kits of Boeing P-26, Curtiss Goshawk. Models had movable stick, rudder, and control surfaces. Robert L. Washburn, 3205 Landsdowne Dr., Wilmington, DE 19810.

WANTED: Kits by Aristocraft, Goshawk, and Sopwith Camel. Svenson—The Wayfarer. Monty Baker, 5045 Heather Dr., Cross Lanes, WV 25313.

MODEL ENGINES: IGNITION, GLOW. Collectors, runners, used, new. Sell, trade, buy. SASE for list. Rob Eierman, 504 Las Poses, Ridgecrest, CA 93555; 619-375-5537.

NOW USE REMOTE CONTROL in model rockets. Plans and instructions $4.95. Signal Systems, Box 11503, Dept. A, Green Bay, WI 54307.

1986 SCALE MASTERS CHAMPIONSHIP on videotape. Edited and narrated footage features 42 aircraft as well as the trophy awards. Running time: 60 minutes. $29.95 postpaid. MasterCard and Visa welcome. Specify Beta or VHS. To order call 702-731-5217 after 5:00 p.m. Pacific time or write Werner Kopp, 2973 Berman, Las Vegas, NV 89109. No CODs please.

COMPULSIVE BUYER SELLING American and British modeling and full-size aviation magazines, kits, plans, engines, radios, propellers, and accessories. Something for everyone. Very attractive prices. Two dollars for extensive list refundable with order. C.E. Munroe, 2-2300 Ogilvie Rd., Gloucester, ON, Canada K1J 7X8.

MANUFACTURING RIGHTS FOR SALE on a patented model aircraft. Will be sold on a royalty basis that's attractive to the manufacture. This aircraft is passed the research phase. The possibilities of manufacturing could range from kit form to the almost ready to fly model made from ABS plastic. The flying characteristics of this patented aircraft are that it's very stable yet highly controllable and flies on an average speed of 15 mph. Requires only a 2-channel radio (throttle and rudder). For more information, please write to 2227 Sherer Ave., Dayton, OH 45414-4635. Please include your phone number with area code for reply.

WANTED: Executive Design Corp., Monocoupe 90-A kit. N.I.B. Contact Bill Hawthorne, 635 Tupper Lake St., Lake Odessa, MI 48849.

Send ad and payment to *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

Non-Commercial classified ads (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each.

Commercial classified ads (rate applies to anyone selling on a commercial basis—retailers, manufacturers, etc.). Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number.

Closing Date for either type of ad is the 15th of the third preceding month (for example, January 15th for the April issue). We do not furnish box numbers. If you would like your ad to run in more than one issue, multiply amount of payment by number of months that ad is to run.

It is not our policy to send sample copies or tear sheets.

SOARING NEWS

(Continued from page 121)

setting world records in power duration.

Willy Pfister and Gary Tschautscher made good use of their German heritage in bringing us some of the latest information on the German sailplane experiments as documented in the German press. The two days wound up with aeroengineer Joe Wurts speaking on the use of composites and a great how-to discussion of the vacuum bagging technique of producing foam-and-glass wings.

The success of the first four symposiums has prompted MARCS to schedule a fifth on October 31 and November 1, 1987. To get on the mailing list for information, drop a card to Dr. Carl Mohs, 5024 Lake Mendota Dr., Madison, Wisconsin 53705.

Jim Gray, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**Addresses pertinent to this article are as follows:*

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S.O.A.R., 23546 W. Fern, Plainfield, IL 60544. ■